APPENDIX I

BACKGROUND SOIL DERIVATION
(Provided on CD)

DERIVATION OF BACKGROUND THRESHOLD VALUES

A total of 9 samples are included in the background soil dataset. The location of each sample is presented in Figure 1 of this attachment. Derivation of background threshold values (BTVs) for all detected analytes in the background dataset is described below.

I. Development of BTVs

A. Preprocessing of Dataset

The main objective of the statistical procedures used in derive BTVs is to model the majority of the data representing the dominant population, while not accommodating the few low or high probability outliers that may not be representative of background conditions. These types of outlying observations can distort the mean and standard deviation calculations, ultimately yielding imprecise estimates of BTVs (i.e., UPLs or UTLs). As such, and consistent with USEPA ProUCL technical guidance, it is highly desirable to identify and remove potential outliers prior to estimating background concentrations. This was first done through qualitative assessment of scatter plots for each analyte (Figure 2). These plots demonstrate a consistent dataset with minimal variability across most analytes. Although review of these scatter plots identified general consistency among a majority of the analytes, a more detailed quantitative analysis was required to identify potential outliers.

To support identification of outliers in this evaluation, the common inter-quartile range (IQR) approach (based on flagging upper and lower fences/thresholds) was followed. Essentially, the IQR is calculated as the 75^{th} percentile – 25^{th} percentile for each compound. The upper fence is calculated as the 75^{th} percentile + (1.5 x IQR) while the lower fence is calculated as the 25^{th} percentile – (1.5 x IQR). Data points that fall either above the upper fence or below the lower fence are identified as outliers and subsequently removed from the dataset.

All data points that were identified as outliers and consequently removed from the final background dataset are documented in Table 1 of this appendix. For further clarification, IQR calculations are presented (along with the upper and lower fence thresholds) at the bottom of this table. Note that for the purposes of outlier identification, all nondetect results were set at ½ their laboratory reporting limit.

B. Derivation of BTVs

Once the dataset was processed, USEPA's ProUCL software package (version 4.1) was used to determine the shape of each data distribution. Goodness-of-fit statistics were used to classify data as following a normal, lognormal, or nondiscernable (nonparametric) distribution. Once the distribution was established, BTVs were estimated using this same software. While USEPA does not provide any recommendations regarding the use of the BTVs, developers of ProUCL software suggest the use of 95% upper prediction limits (UPLs) to estimate background parameters (USEPA, 2010). UPLs are defined as the upper boundaries of a prediction interval for an independently obtained observation and are often used in background evaluations (USEPA, 2010). They are commonly referred to as reasonable, yet conservative estimates of background, particularly when planning to perform point-by-point comparisons of site and background concentrations. As such, 95% UPLs were selected to represent final background concentrations for each analyte at the site.

Based on the distribution of the datasets, 95% UPLs were estimated through the use parametric or nonparametric statistics. For datasets that fit either a normal or lognormal distribution and where at least 70% of the results were reported as detected concentrations, the corresponding normal or lognormal UPL was retained. For analytes that did not fit either distribution or for those which fit more than two distributions, nonparametric techniques (based on ranking) were employed in order to reliably estimate an upper limit. Per ProUCL guidance, nonparametric statistics were also used for all analytes that were infrequently detected (<70% detected) and/or reported with varying detection limits.

When nonparametric statistics are used, ProUCL guidance (USEPA, 2010) provides no specific recommendations regarding the most appropriate upper limit to use. However, the technical guidance document (USEPA, 2010) suggests the use of the Kaplan-Meier statistic (KM) estimates and their associated upper limits to estimate BTVs for datasets that are not highly left skewed and/or datasets with multiple detection limits. Since much of the data used in this evaluation fits both of these criteria, 95% KM estimates were retained for all datasets with nondetects requiring nonparametric statistics.

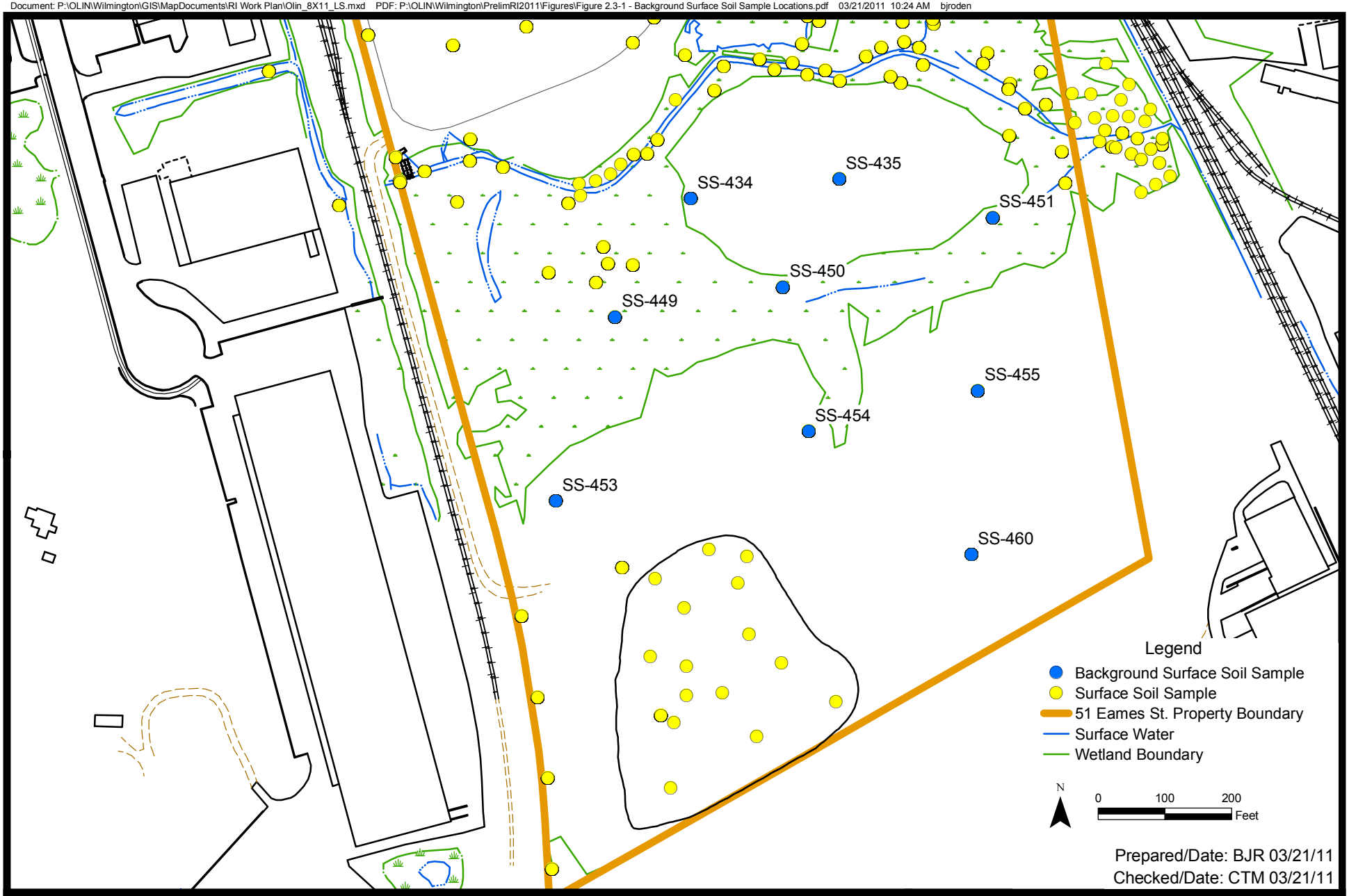
ProUCL outputs for estimating background concentrations are presented in Table 2 of this appendix. Note that when datasets for a certain analyte only included one distinct detected value (and could therefore not be processed by ProUCL), or when all results for a given analyte were reported as nondetect, BTVs were not estimated.

Summary statistics (after removing outliers) including the number of samples, frequency of detection, minimum detected concentrations, maximum detected concentrations, data distribution, and final 95% UPLs are presented in Table 3 of this appendix.

References:

USEPA, 2010. ProUCL Version 4.1.00 Technical Guide (Draft). Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R-07/041. May.

Document: P:\OLIN\Wilmington\GIS\MapDocuments\RI Work Plan\Olin_8X11_LS.mxd PDF: P:\OLIN\Wilmington\PrelimRI2011\Figures\Figure 2.3-1 - Background Surface Soil Sample Locations.pdf 03/21/2011 10:24 AM bjroden



Preliminary Remedial Investigation Report
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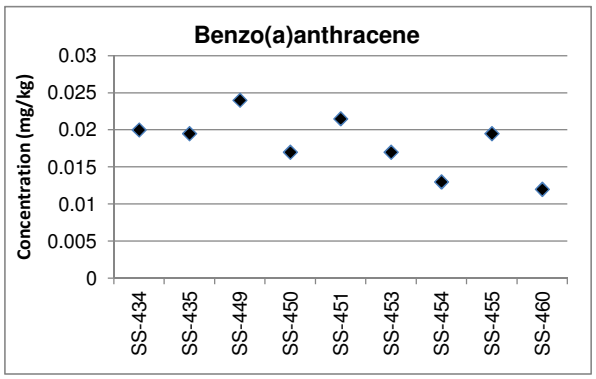
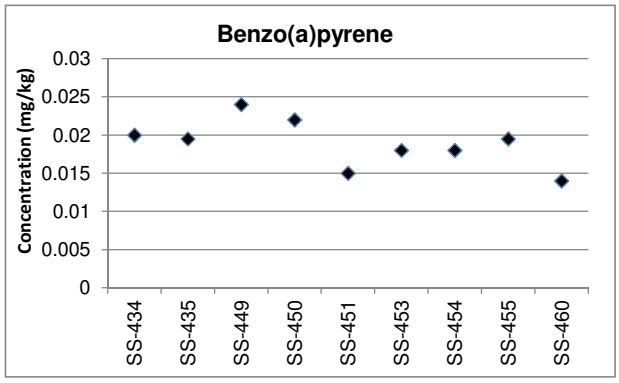
Wilmington, Massachusetts

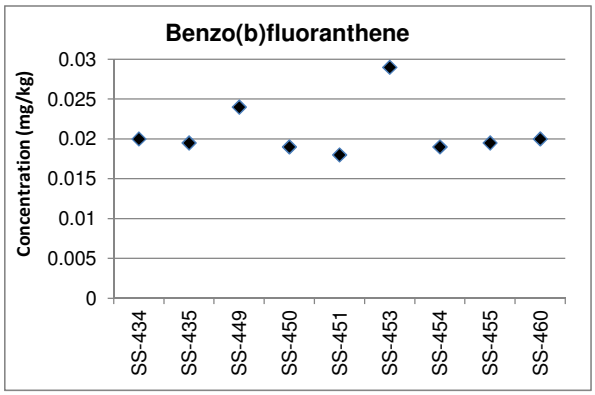
MACTEC

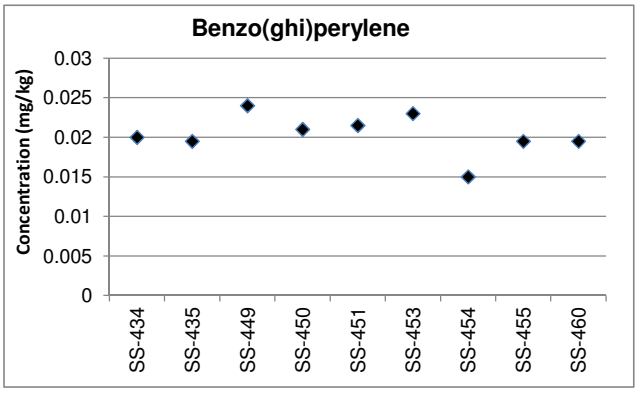
Figure 1
Background Surface Soil Sample Locations

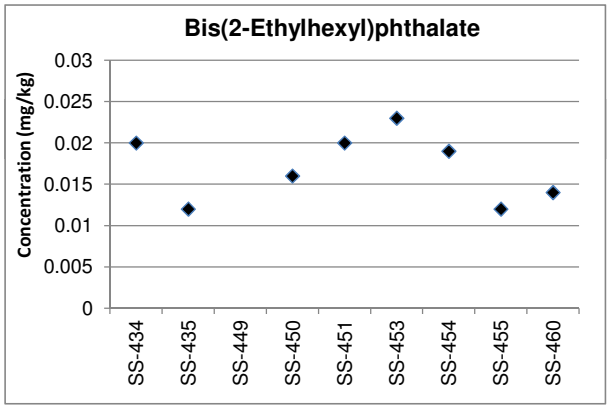
Figure 2: Plots of Background Surface Soil Data
OLIN Wilmington
OU1 Background Soil Samples

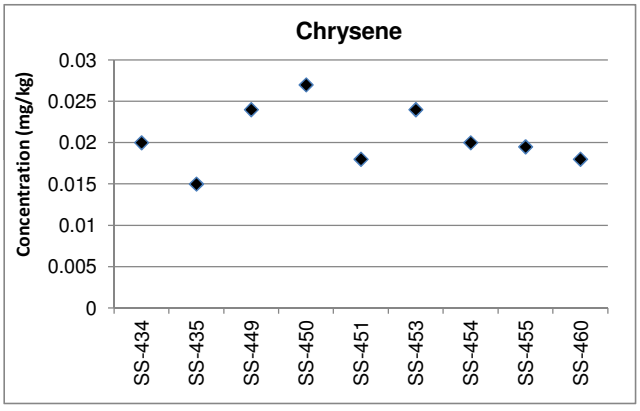


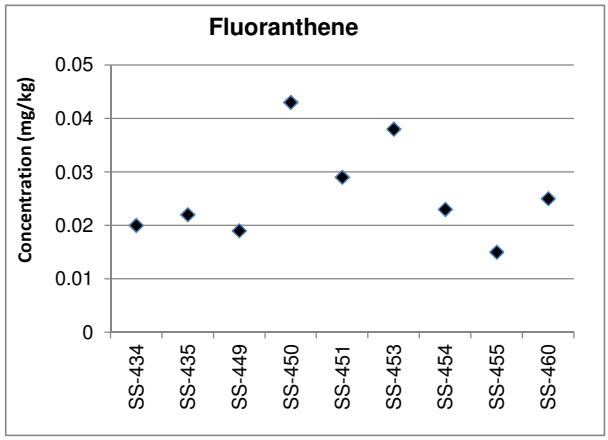


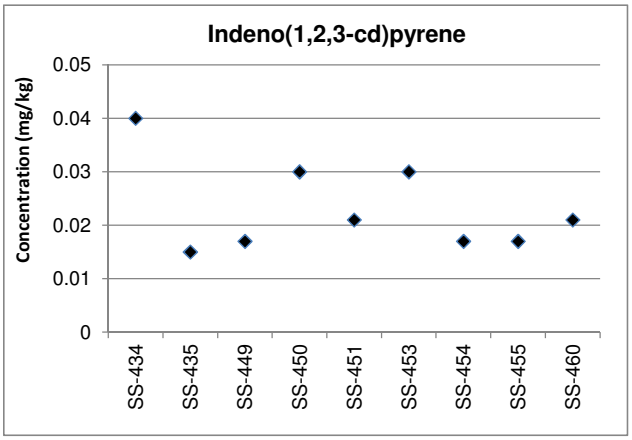






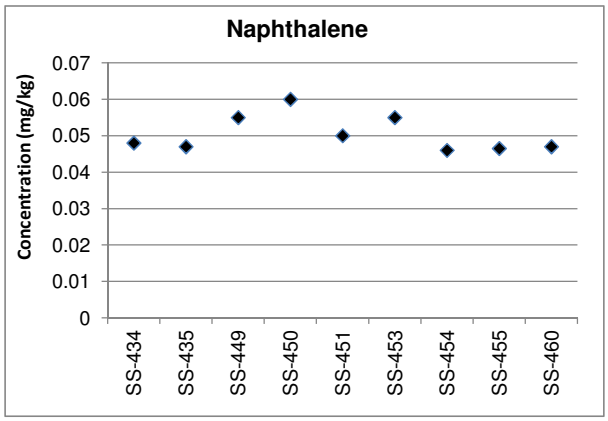


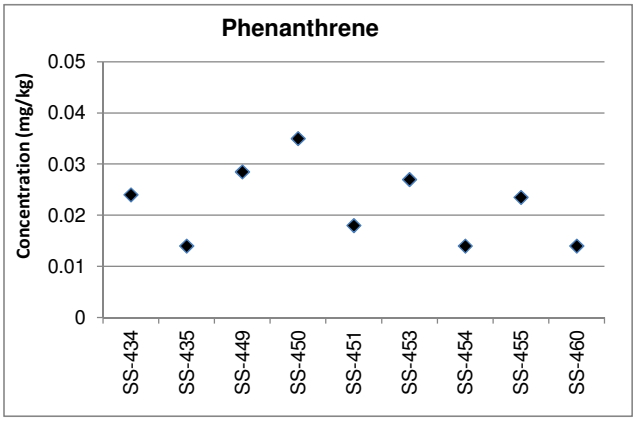


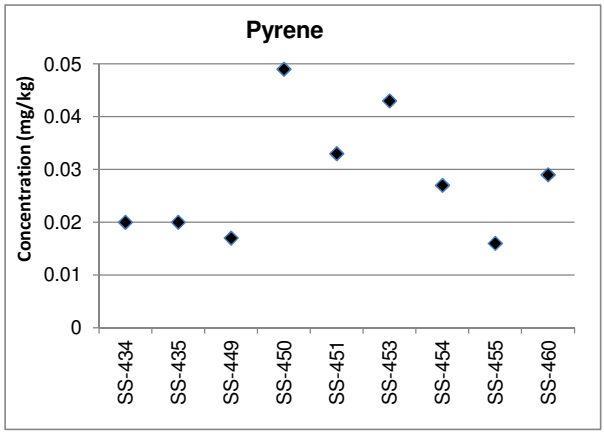


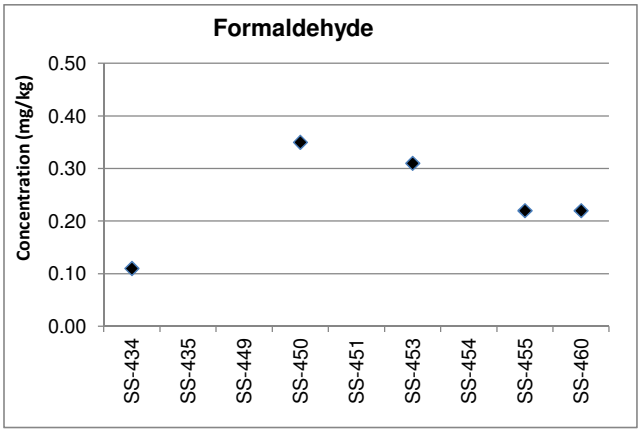
Notes: All nondetect results are presented at 1/2 the laboratory reporting limit in graphs.

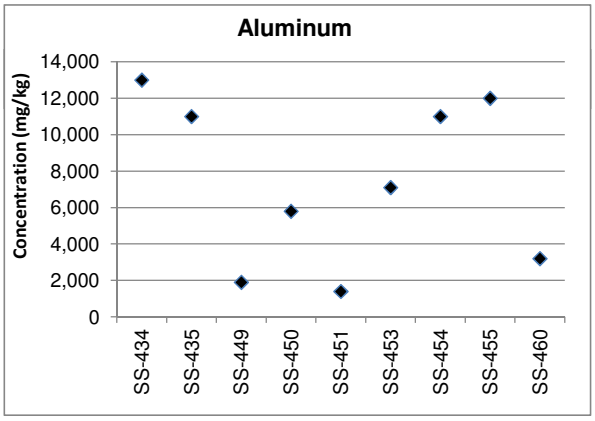
Figure 2: Plots of Background Surface Soil Data
OLIN Wilmington
OU1 Background Soil Samples

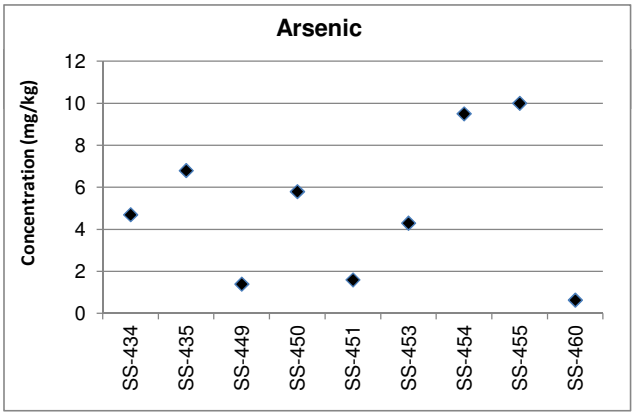


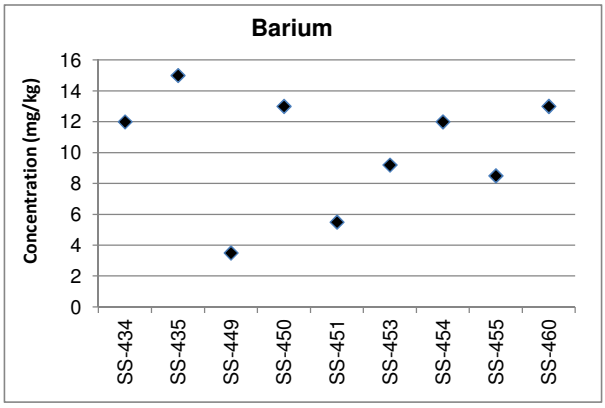


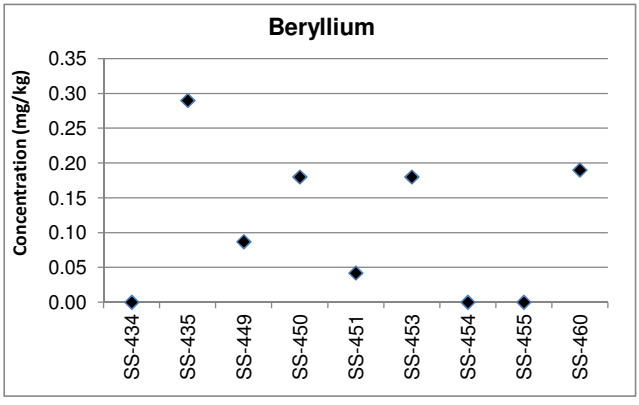












Notes: All nondetect results are presented at 1/2 the laboratory reporting limit in graphs.

Figure 2: Plots of Background Surface Soil Data
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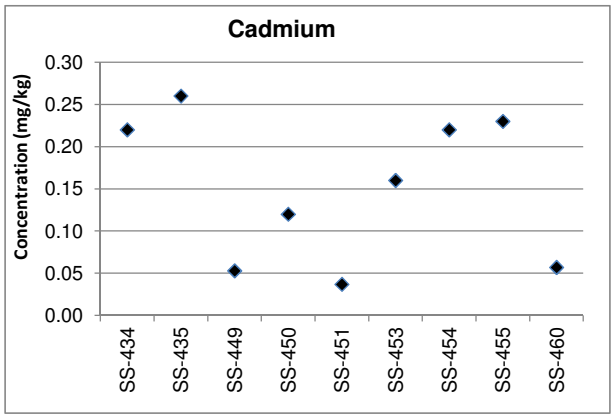
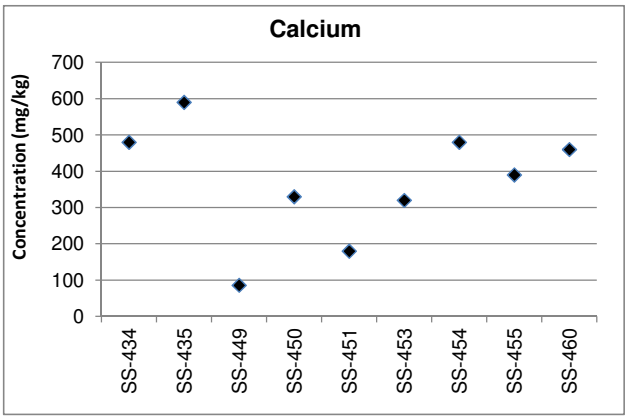
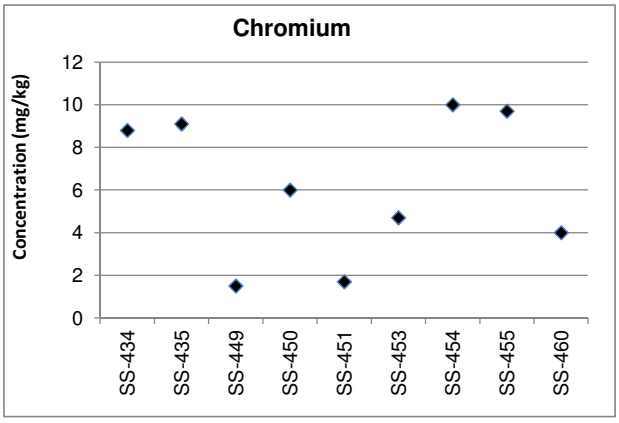
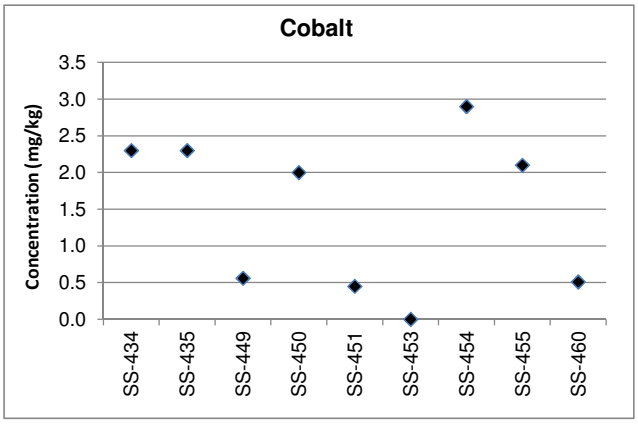
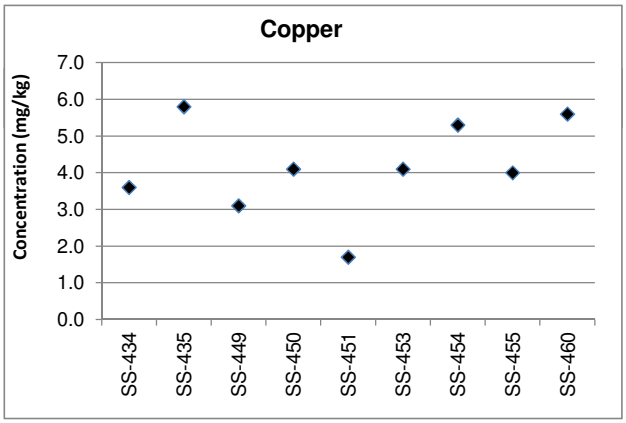
OU1 Background Soil Samples

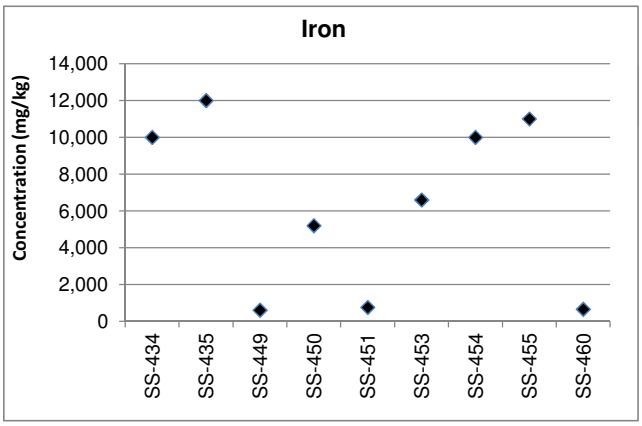


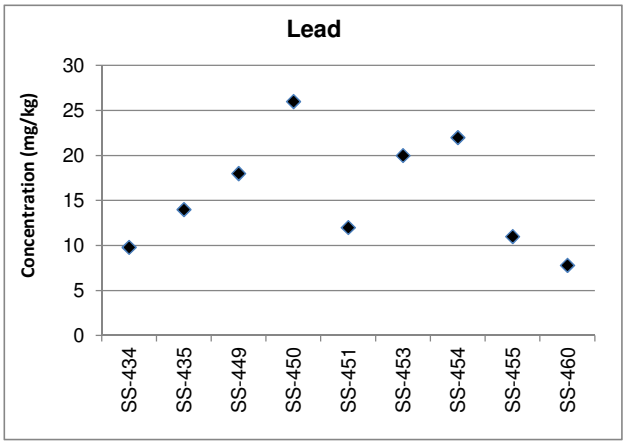


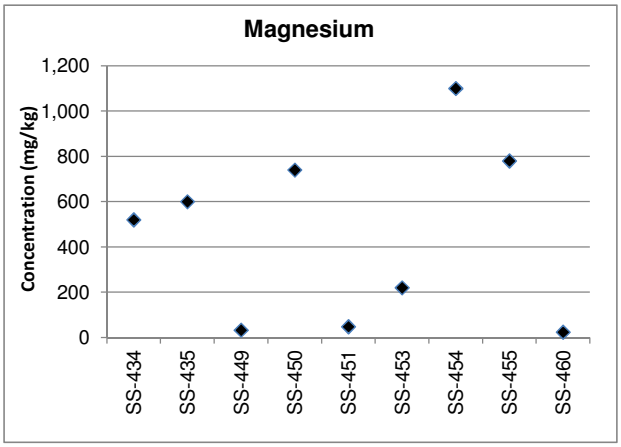












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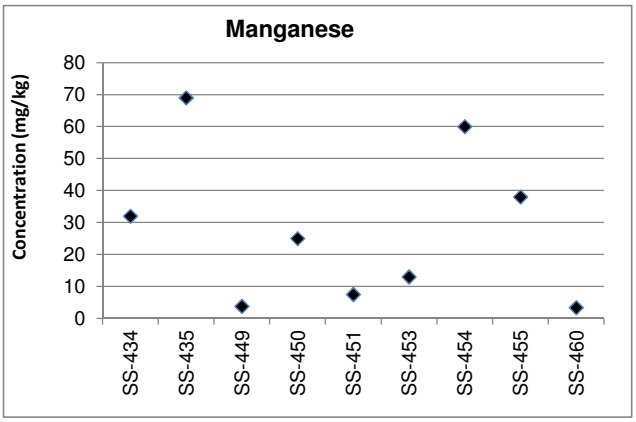

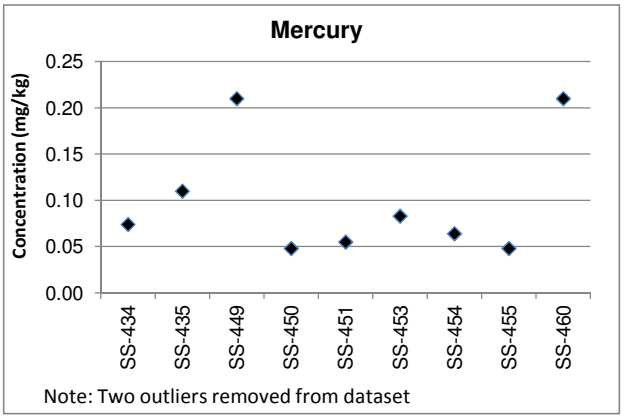

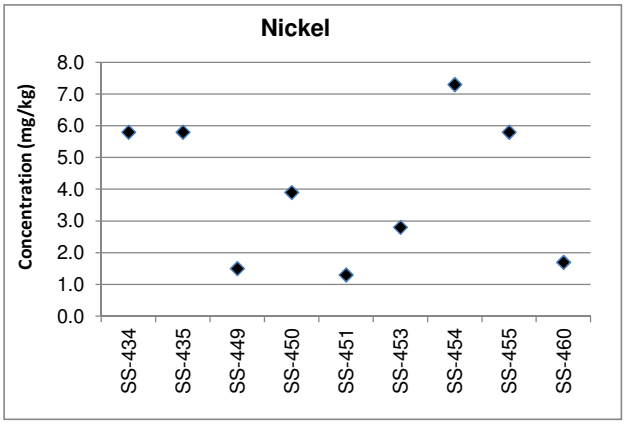

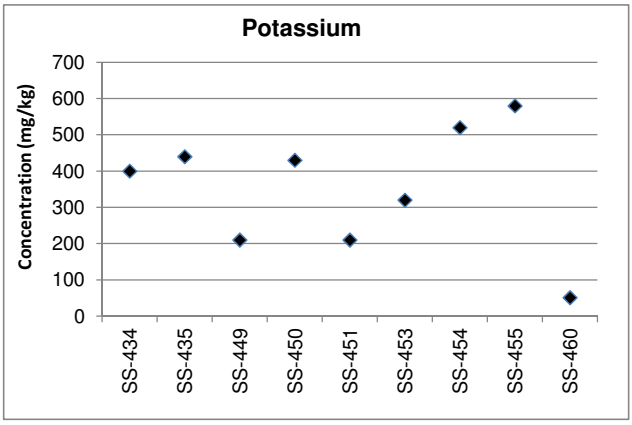

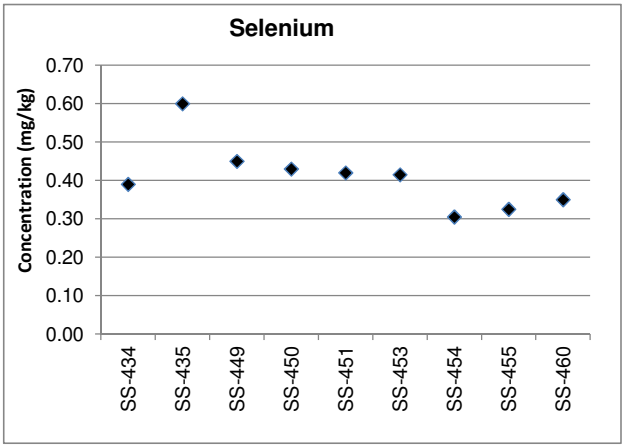

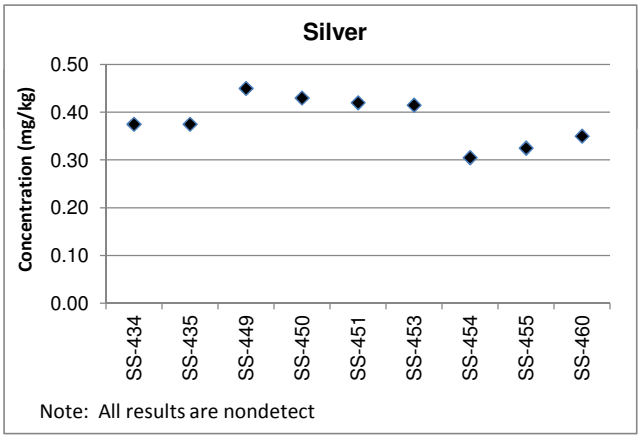

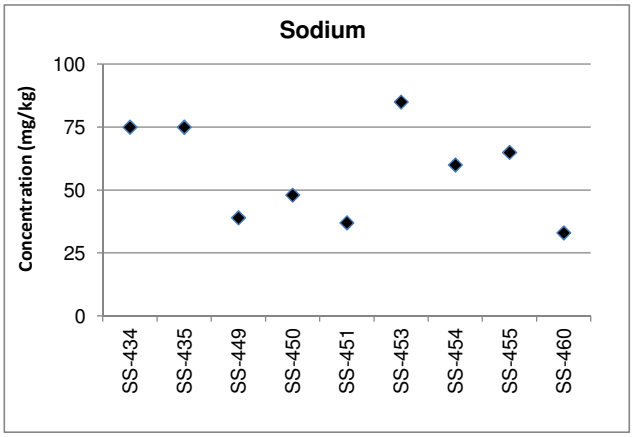

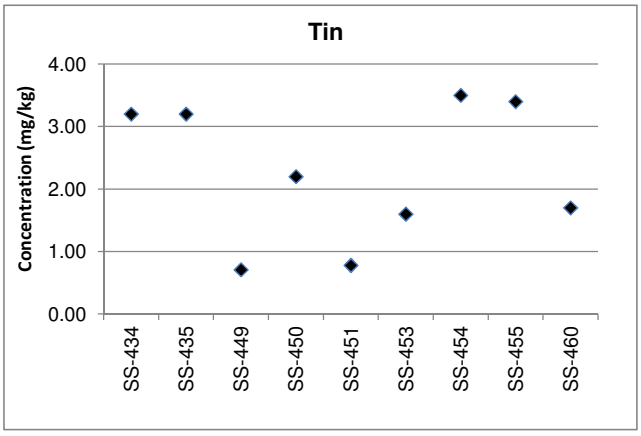

Notes: All nondetect results are presented at 1/2 the laboratory reporting limit in graphs.

Figure 2: Plots of Background Surface Soil Data
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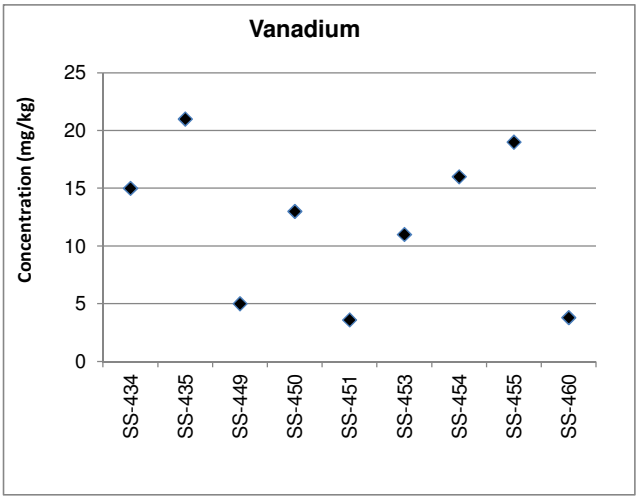
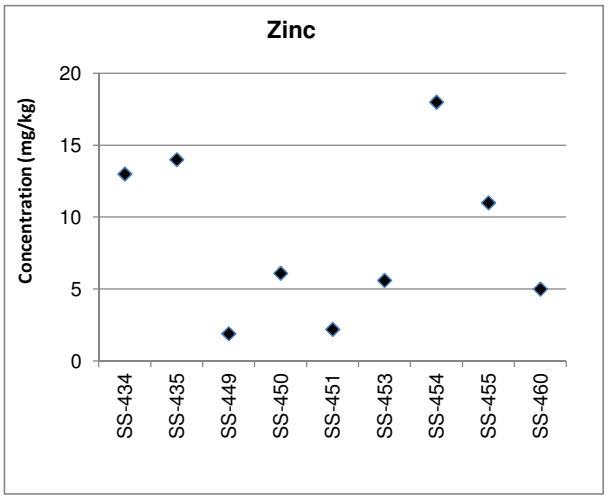
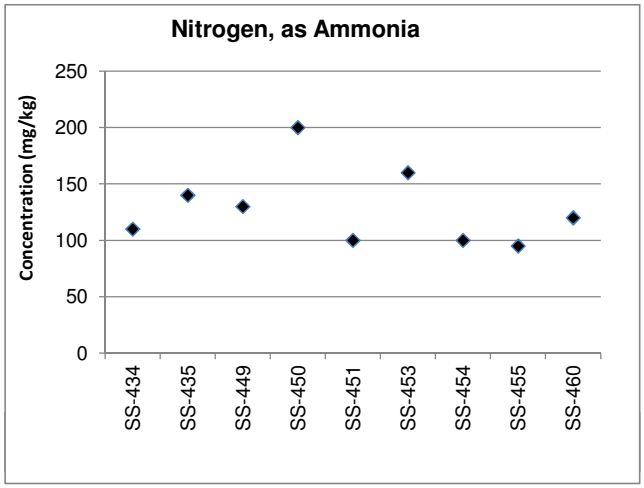
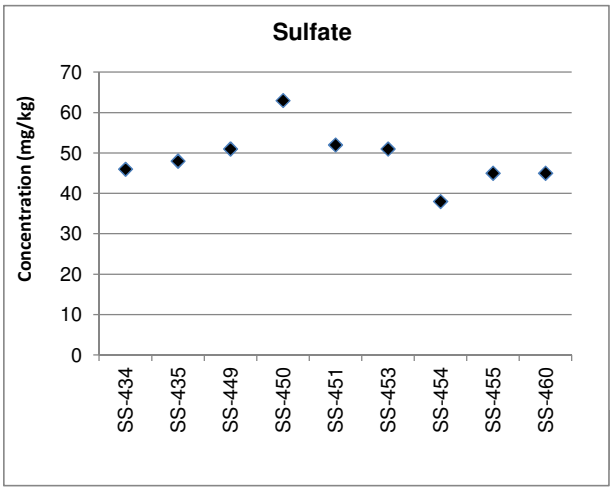
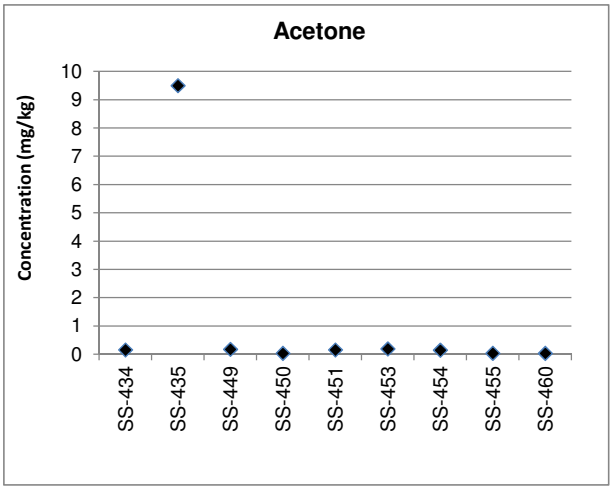
OU1 Background Soil Samples

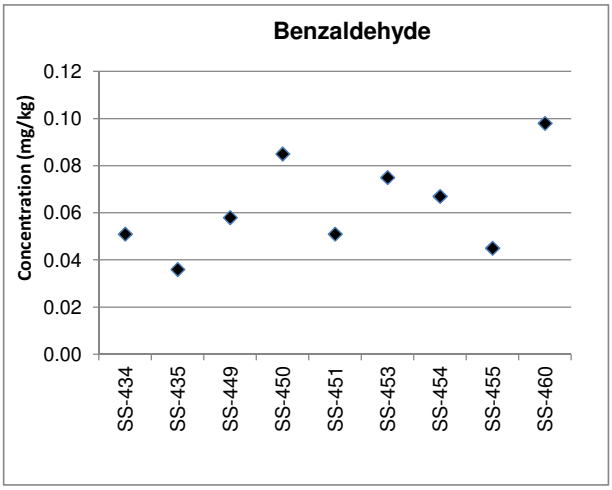












Notes: All nondetect results are presented at 1/2 the laboratory reporting limit in graphs.

Table 1: Identification of Outliers in Background Soil

Sample ID	Benzo(a)anthracene		Benzo(a)pyrene		Benzo(b)fluor.		Benzo(ghi)per.		BEHP		Chrysene		Fluoranthene		Indeno(1,2,3-cd)py.	
SS-434	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U	0.04	UJ
SS-435	0.039	U	0.039	U	0.039	U	0.039	U	0.012	J	0.015	J	0.022	J	0.015	J
SS-449	0.048	U	0.048	U	0.048	U	0.048	U	0.031	J	0.048	U	0.019	J	0.017	J
SS-450	0.017	J	0.022	J	0.019	J	0.021	J	0.016	J	0.027	J	0.043	J	0.03	J
SS-451	0.043	U	0.015	J	0.018	J	0.043	U	0.02	J	0.018	J	0.029	J	0.021	J
SS-453	0.017	J	0.018	J	0.029	J	0.046	U	0.046	U	0.024	J	0.038	J	0.03	J
SS-454	0.013	J	0.018	J	0.019	J	0.015	J	0.038	U	0.02	J	0.023	J	0.017	J
SS-455	0.039	U	0.039	U	0.039	U	0.039	U	0.012	J	0.039	U	0.015	J	0.017	J
SS-460	0.012	J	0.014	J	0.02	J	0.039	U	0.014	J	0.018	J	0.025	J	0.021	J
IQR REVIEW																
Max	0.048		0.048		0.048		0.048		0.046		0.048		0.043		0.04	
25%	0.017		0.018		0.019		0.039		0.014		0.018		0.022		0.017	
50%	0.039		0.022		0.029		0.039		0.02		0.024		0.025		0.021	
75%	0.04		0.039		0.039		0.043		0.038		0.039		0.038		0.03	
90%	0.044		0.0416		0.0416		0.0464		0.0412		0.0416		0.0406		0.032	
95%	0.046		0.0448		0.0448		0.0472		0.0436		0.0448		0.0418		0.036	
IQR	0.023		0.021		0.02		0.004		0.024		0.021		0.016		0.013	
Upper IQR	0.0745		0.0705		0.069		0.049		0.074		0.0705		0.062		0.0495	
Lower IQR	-0.09475		-0.08775		-0.0845		-0.0345		-0.097		-0.08775		-0.071		-0.05725	

Notes:
All results reported in milligrams per kilogram (mg/kg)
U - analyte not detected; concentration presented represents laboratory reporting limit
J - concentration is estimated
IQR - interquartile range
Highlighted cells indicate outliers. Outliers identified as results reported above the calculated Upper IQR or below the calculated Lower IQR

Table 1: Identification of Outliers in Background Soil

Sample ID	Naphthalene		Phenanthrene		Pyrene		Formaldehyde		Aluminum	Arsenic		Barium	Beryllium	
SS-434	0.096	U	0.048	U	0.04	U	0.11	J	13000	4.7		12	0.3	
SS-435	0.094	U	0.014	J	0.02	J			11000	6.8		15	0.29	J
SS-449	0.11	U	0.057	U	0.017	J			1900	1.4	J	3.5	0.087	J
SS-450	0.12	U	0.035	J	0.049	J	0.35		5800	5.8		13	0.18	J
SS-451	0.1	U	0.018	J	0.033	J			1400	1.6	J	5.5	0.042	J
SS-453	0.11	U	0.027	J	0.043	J	0.31		7100	4.3		9.2	0.18	J
SS-454	0.092	U	0.014	J	0.027	J			11000	9.5		12	0.32	
SS-455	0.093	U	0.047	U	0.016	J	0.22		12000	10		8.5	0.28	
SS-460	0.094	U	0.014	J	0.029	J	0.22		3200	0.64	J	13	0.19	J
IQR REVIEW														
Max	0.12		0.057		0.049		0.35		13000	10		15	0.32	
25%	0.094		0.014		0.02		0.22		3200	1.6		8.5	0.18	
50%	0.096		0.027		0.029		0.22		7100	4.7		12	0.19	
75%	0.11		0.047		0.04		0.31		11000	6.8		13	0.29	
90%	0.112		0.0498		0.0442		0.334		12200	9.6		13.4	0.304	
95%	0.116		0.0534		0.0466		0.342		12600	9.8		14.2	0.312	
IQR	0.016		0.033		0.02		0.09		7800	5.2		4.5	0.11	
Upper IQR	0.134		0.0965		0.07		0.445		22700	14.6		19.75	0.455	
Lower IQR	-0.107		-0.13075		-0.085		-0.4475		-30850	-20.3		-21.125	-0.5025	

Notes:
All results reported in milligrams per kilogram (mg/kg)
U - analyte not detected; concentration presented represents laboratory reporting limit
J - concentration is estimated
IQR - interquartile range
Highlighted cells indicate outliers. Outliers identified as results reported above the calculated Upper IQR or below the calculated Lower IQR

Table 1: Identification of Outliers in Background Soil

Sample ID	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
SS-434	0.22 J	480	8.8	2.3	3.6	10000	9.8	520
SS-435	0.26 J	590	9.1	2.3	5.8	12000	14	600
SS-449	0.053 J	86	1.5	0.56 J	3.1	610	18	33
SS-450	0.12 J	330	6	2	4.1	5200	26	740
SS-451	0.037 J	180	1.7	0.45 J	1.7 J	760	12	48
SS-453	0.16 J	320	4.7	0.91	4.1	6600	20	220
SS-454	0.22 J	480	10	2.9	5.3	10000	22	1100
SS-455	0.23 J	390	9.7	2.1	4	11000	11	780
SS-460	0.057 J	460	4	0.51 J	5.6	660	7.8	24
IQR REVIEW								
Max	0.26	590	10	2.9	5.8	12000	26	1100
25%	0.057	320	4	0.56	3.6	760	11	48
50%	0.16	390	6	2	4.1	6600	14	520
75%	0.22	480	9.1	2.3	5.3	10000	20	740
90%	0.236	502	9.76	2.42	5.64	11200	22.8	844
95%	0.248	546	9.88	2.66	5.72	11600	24.4	972
IQR	0.163	160	5.1	1.74	1.7	9240	9	692
Upper IQR	0.4645	720	16.75	4.91	7.85	23860	33.5	1778
Lower IQR	-0.63975	-760	-21.125	-6.805	-8.175	-35030	-39.25	-2619

Notes:
All results reported in milligrams per kilogram (mg/kg)
U - analyte not detected; concentration presented represents laboratory reporting limit
J - concentration is estimated
IQR - interquartile range
Highlighted cells indicate outliers. Outliers identified as results reported above the calculated Upper IQR or below the calculated Lower IQR

Table 1: Identification of Outliers in Background Soil

Sample ID	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Tin
SS-434	32	0.074 J	5.8	400	0.39 J	0.75 U	150 U	3.2 J
SS-435	69	0.11 J	5.8	440	0.6 J	0.75 U	150 U	3.2 J
SS-449	3.8	0.21 U	1.5 J	210 J	0.9 U	0.9 U	39 J	0.71 J
SS-450	25	0.048 J	3.9	430	0.86 U	0.86 U	48 J	2.2 J
SS-451	7.5	0.055 J	1.3 J	210 J	0.84 U	0.84 U	37 J	0.78 J
SS-453	13	0.083 J	2.8	320 J	0.83 U	0.83 U	170 U	1.6 J
SS-454	60	0.064 J	7.3	520	0.61 U	0.61 U	120 U	3.5 J
SS-455	38	0.048 J	5.8	580	0.65 U	0.65 U	130 U	3.4 J
SS-460	3.4	0.21 U	1.7	51 J	0.7 U	0.7 U	33 J	1.7 J
IQR REVIEW								
Max	69	0.21	7.3	580	0.9	0.9	170	3.5
25%	7.5	0.055	1.7	210	0.61	0.7	39	1.6
50%	25	0.074	3.9	400	0.7	0.75	120	2.2
75%	38	0.11	5.8	440	0.84	0.84	150	3.2
90%	61.8	0.21	6.1	532	0.868	0.868	154	3.42
95%	65.4	0.21	6.7	556	0.884	0.884	162	3.46
IQR	30.5	0.055	4.1	230	0.23	0.14	111	1.6
Upper IQR	83.75	0.1925	11.95	785	1.185	1.05	316.5	5.6
Lower IQR	-118.125	-0.23375	-16.225	-967.5	-1.1675	-0.875	-435.75	-6.8

Notes:
All results reported in milligrams per kilogram (mg/kg)
U - analyte not detected; concentration presented represents laboratory reporting limit
J - concentration is estimated
IQR - interquartile range
Highlighted cells indicate outliers. Outliers identified as results reported above the calculated Upper IQR or below the calculated Lower IQR

Table 1: Identification of Outliers in Background Soil

Sample ID	Vanadium	Zinc		Nitrogen, as Ammonia	Sulfate		Acetone		Benzaldehyde	
SS-434	15	13		110	46	U	0.31	UJ	0.051	
SS-435	21	14		140	48	U	19	UJ	0.036	J
SS-449	5	1.9	J	130	51	U	0.35	UJ	0.058	
SS-450	13	6.1		200	63		0.034	J	0.085	
SS-451	3.6	2.2	J	100	52	U	0.31	UJ	0.051	
SS-453	11	5.6		160	51	U	0.38	UJ	0.075	
SS-454	16	18		100	38	U	0.29	UJ	0.067	
SS-455	19	11		95	45	U	0.035	J	0.045	
SS-460	3.8	5		120	45	U	0.034	J	0.098	
IQR REVIEW										
Max	21	18		200	63		19		0.098	
25%	5	5		100	45		0.035		0.051	
50%	13	6.1		120	48		0.31		0.058	
75%	16	13		140	51		0.35		0.075	
90%	19.4	14.8		168	54.2		4.104		0.0876	
95%	20.2	16.4		184	58.6		11.552		0.0928	
IQR	11	8		40	6		0.315		0.024	
Upper IQR	32.5	25		200	60		0.8225		0.111	
Lower IQR	-43.75	-32.5		-200	-45		-1.19875		-0.1155	

Notes:
All results reported in milligrams per kilogram (mg/kg)
U - analyte not detected; concentration presented represents laboratory reporting limit
J - concentration is estimated
IQR - interquartile range
Highlighted cells indicate outliers. Outliers identified as results reported above the calculated Upper IQR or below the calculated Lower IQR

Prepared By/Date: EYM 10/1/12
Checked By/Date: RRD 10/1/12

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Data	9	Number of Detected Data	4
Number of Distinct Detected Data	3	Number of Non-Detect Data	5
Tolerance Factor	2.454	Percent Non-Detects	55.56%

Raw Statistics

Minimum Detected	0.012
Maximum Detected	0.017
Mean of Detected	0.0148
SD of Detected	0.00263
Minimum Non-Detect	0.039
Maximum Non-Detect	0.048

Log-transformed Statistics

Minimum Detected	-4.423
Maximum Detected	-4.075
Mean of Detected	-4.229
SD of Detected	0.181
Minimum Non-Detect	-3.244
Maximum Non-Detect	-3.037

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.813
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean		0.0182
SD		0.00386
95% UTL	90% Coverage	0.0277
	95% UPL (t)	0.0257
	90% Percentile (z)	0.0231
	95% Percentile (z)	0.0245
	99% Percentile (z)	0.0272

Maximum Likelihood Estimate(MLE) Method N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.823
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)		-4.03
SD (Log Scale)		0.227
95% UTL	90% Coverage	0.0311
	95% UPL (t)	0.0278
	90% Percentile (z)	0.0238
	95% Percentile (z)	0.0258
	99% Percentile (z)	0.0302

Log ROS Method

Mean in Original Scale		0.0147
SD in Original Scale		0.00177
Mean in Log Scale		-4.229
SD in Log Scale		0.122
95% UTL	90% Coverage	0.0196
	95% UPL (t)	0.0185
	90% Percentile (z)	0.017
	95% Percentile (z)	0.0178
	99% Percentile (z)	0.0193

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	10.48
Theta Star	0.00141
nu star	83.82
A-D Test Statistic	0.536
5% A-D Critical Value	0.656
K-S Test Statistic	0.338
5% K-S Critical Value	0.394

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0149
Median	0.0151
SD	0.00178
k star	50.99
Theta star	0.000292
Nu star	917.8
95% Percentile of Chisquare (2k)	126.6
90% Percentile	0.0176
95% Percentile	0.0185
99% Percentile	0.0202

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0148
SD		0.00228
SE of Mean		0.00131
95% KM UTL with	90% Coverage	0.0203
95% KM Chebyshev UPL		0.0252
95% KM UPL (t)		0.0192
90% Percentile (z)		0.0177
95% Percentile (z)		0.0185
99% Percentile (z)		0.02

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0187
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0187
95% WH Approx. Gamma UTL with	90% Coverage	0.0197
95% HW Approx. Gamma UTL with	90% Coverage	0.0198

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Number of Valid Data	9	Number of Detected Data	5
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
Tolerance Factor	2.454	Percent Non-Detects	44.44%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.014	Minimum Detected	-4.269
Maximum Detected	0.022	Maximum Detected	-3.817
Mean of Detected	0.0174	Mean of Detected	-4.064
SD of Detected	0.00313	SD of Detected	0.177
Minimum Non-Detect	0.039	Minimum Non-Detect	-3.244
Maximum Non-Detect	0.048	Maximum Non-Detect	-3.037

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.931
5% Shapiro Wilk Critical Value	0.762

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method		
Mean		0.0189
SD		0.00313
95% UTL	90% Coverage	0.0266
	95% UPL (t)	0.025
	90% Percentile (z)	0.0229
	95% Percentile (z)	0.024
	99% Percentile (z)	0.0262
Maximum Likelihood Estimate(MLE) Method		N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.943
5% Shapiro Wilk Critical Value	0.762

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method		
Mean (Log Scale)		-3.982
SD (Log Scale)		0.17
95% UTL	90% Coverage	0.0283
	95% UPL (t)	0.026
	90% Percentile (z)	0.0232
	95% Percentile (z)	0.0247
	99% Percentile (z)	0.0277
Log ROS Method		
Mean in Original Scale		0.0173
SD in Original Scale		0.00237
Mean in Log Scale		-4.064
SD in Log Scale		0.135
95% UTL	90% Coverage	0.0239
	95% UPL (t)	0.0224
	90% Percentile (z)	0.0204
	95% Percentile (z)	0.0214
	99% Percentile (z)	0.0235

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	15.96
Theta Star	0.00109
nu star	159.6
A-D Test Statistic	0.306
5% A-D Critical Value	0.678
K-S Test Statistic	0.205
5% K-S Critical Value	0.357

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0176
Median	0.0179
SD	0.00238
k star	41.22
Theta star	0.000426
Nu star	742
95% Percentile of Chisquare (2k)	104.6
90% Percentile	0.0211
95% Percentile	0.0223
99% Percentile	0.0245

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0174
SD		0.0028
SE of Mean		0.0014
95% KM UTL with	90% Coverage	0.0243
95% KM Chebyshev UPL		0.0303
95% KM UPL (t)		0.0229
90% Percentile (z)		0.021
95% Percentile (z)		0.022
99% Percentile (z)		0.0239

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0225
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0226
95% WH Approx. Gamma UTL with	90% Coverage	0.0239
95% HW Approx. Gamma UTL with	90% Coverage	0.024

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.018	Minimum	-4.017
Maximum	0.048	Maximum	-3.037
Second Largest	0.04	Second Largest	-3.219
First Quartile	0.019	First Quartile	-3.963
Median	0.029	Median	-3.54
Third Quartile	0.039	Third Quartile	-3.244
Mean	0.0301	Mean	-3.571
Geometric Mean	0.0281	SD	0.395
SD	0.0116		
Coefficient of Variation	0.385		
Skewness	0.263		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.852	Shapiro Wilk Test Statistic	0.841
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	0.0585	95% UTL with 90% Coverage	0.0741
95% UPL (t)	0.0528	95% UPL (t)	0.061
90% Percentile (z)	0.045	90% Percentile (z)	0.0467
95% Percentile (z)	0.0492	95% Percentile (z)	0.0538
99% Percentile (z)	0.0571	99% Percentile (z)	0.0705

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test

k star	5.064
Theta Star	0.00595
MLE of Mean	0.0301
MLE of Standard Deviation	0.0134
nu star	91.15
A-D Test Statistic	0.732
5% A-D Critical Value	0.722
K-S Test Statistic	0.266
5% K-S Critical Value	0.28

Data follow Appx. Gamma Distribution at 5% Significance Leve

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	0.0416
95% Percentile	0.0448
99% Percentile	0.0474

Assuming Gamma Distribution

90% Percentile	0.048
95% Percentile	0.055
99% Percentile	0.0696
95% WH Approx. Gamma UPL	0.0572
95% HW Approx. Gamma UPL	0.058
95% WH Approx. Gamma UTL with 90% Coverage	0.0666
95% HW Approx. Gamma UTL with 90% Coverage	0.0681

95% UTL with 90% Coverage	0.048
95% Percentile Bootstrap UTL with 90% Coverage	0.048
95% BCA Bootstrap UTL with 90% Coverage	0.048
95% UPL	0.048
95% Chebyshev UPL	0.0833
Upper Threshold Limit Based upon IQR	0.069

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Benzo(ghi)perylene

General Statistics

Number of Valid Data	9	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	7

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful and reliable test statistics and estimates.
No statistics will be produced!

Tolerance Factor	2.454	Percent Non-Detects	77.78%

Raw Statistics

Minimum Detected	0.015
Maximum Detected	0.021
Mean of Detected	0.018
SD of Detected	0.00424
Minimum Non-Detect	0.039
Maximum Non-Detect	0.048

Log-transformed Statistics

Minimum Detected	-4.2
Maximum Detected	-3.863
Mean of Detected	-4.031
SD of Detected	0.238
Minimum Non-Detect	-3.244
Maximum Non-Detect	-3.037

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method		
Mean		0.0203
SD		0.00257
95% UTL	90% Coverage	0.0266
95% UPL (t)		0.0254
90% Percentile (z)		0.0236
95% Percentile (z)		0.0246
99% Percentile (z)		0.0263
Maximum Likelihood Estimate(MLE) Method		N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method		
Mean (Log Scale)		-3.903
SD (Log Scale)		0.134
95% UTL	90% Coverage	0.0281
95% UPL (t)		0.0263
90% Percentile (z)		0.024
95% Percentile (z)		0.0252
99% Percentile (z)		0.0276
Log ROS Method		
Mean in Original Scale		N/A
SD in Original Scale		N/A
Mean in Log Scale		N/A
SD in Log Scale		N/A
95% UTL	90% Coverage	N/A
95% UPL (t)		N/A
90% Percentile (z)		N/A
95% Percentile (z)		N/A
99% Percentile (z)		N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data	
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
95% Percentile of Chisquare (2k)	N/A
90% Percentile	N/A
95% Percentile	N/A
99% Percentile	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method		
Mean		0.018
SD		0.003
SE of Mean		0.003
95% KM UTL with	90% Coverage	0.0254
95% KM Chebyshev UPL		0.0318
95% KM UPL (t)		0.0239
90% Percentile (z)		0.0218
95% Percentile (z)		0.0229
99% Percentile (z)		0.025

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		N/A
95% Hawkins Wixley (HW) Approx. Gamma UPL		N/A
95% WH Approx. Gamma UTL with	90% Coverage	N/A
95% HW Approx. Gamma UTL with	90% Coverage	N/A

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Bis(2-Ethylhexyl)phthalate

General Statistics

Number of Valid Data	9	Number of Detected Data	6
Number of Distinct Detected Data	5	Number of Non-Detect Data	3
Tolerance Factor	2.454	Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.012
Maximum Detected	0.031
Mean of Detected	0.0175
SD of Detected	0.00726
Minimum Non-Detect	0.038
Maximum Non-Detect	0.046

Log-transformed Statistics

Minimum Detected	-4.423
Maximum Detected	-3.474
Mean of Detected	-4.106
SD of Detected	0.365
Minimum Non-Detect	-3.27
Maximum Non-Detect	-3.079

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.813
5% Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

	Mean	0.0186
	SD	0.00604
95% UTL	90% Coverage	0.0334
	95% UPL (t)	0.0304
	90% Percentile (z)	0.0263
	95% Percentile (z)	0.0285
	99% Percentile (z)	0.0326

Maximum Likelihood Estimate(MLE) Method N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

	Mean (Log Scale)	-4.031
	SD (Log Scale)	0.313
95% UTL	90% Coverage	0.0383
	95% UPL (t)	0.0328
	90% Percentile (z)	0.0265
	95% Percentile (z)	0.0297
	99% Percentile (z)	0.0368

Log ROS Method

	Mean in Original Scale	0.0172
	SD in Original Scale	0.00576
	Mean in Log Scale	-4.106
	SD in Log Scale	0.288
95% UTL	90% Coverage	0.0334
	95% UPL (t)	0.029
	90% Percentile (z)	0.0238
	95% Percentile (z)	0.0265
	99% Percentile (z)	0.0322

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.336
Theta Star	0.00404
nu star	52.03
A-D Test Statistic	0.451
5% A-D Critical Value	0.698
K-S Test Statistic	0.223
5% K-S Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0178
Median	0.0183
SD	0.00575
k star	8.421
Theta star	0.00211
Nu star	151.6
95% Percentile of Chisquare (2k)	27.38
90% Percentile	0.0259
95% Percentile	0.0289
99% Percentile	0.035

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0175
SD		0.00663
SE of Mean		0.00296
95% KM UTL with	90% Coverage	0.0338
95% KM Chebyshev UPL		0.0479
95% KM UPL (t)		0.0305
90% Percentile (z)		0.026
95% Percentile (z)		0.0284
99% Percentile (z)		0.0329

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0297
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0298
95% WH Approx. Gamma UTL with	90% Coverage	0.0336
95% HW Approx. Gamma UTL with	90% Coverage	0.0339

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Chrysene

General Statistics

Number of Valid Data	9	Number of Detected Data	6
Number of Distinct Detected Data	5	Number of Non-Detect Data	3
Tolerance Factor	2.454	Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.015	Minimum Detected	-4.2
Maximum Detected	0.027	Maximum Detected	-3.612
Mean of Detected	0.0203	Mean of Detected	-3.915
SD of Detected	0.00441	SD of Detected	0.214
Minimum Non-Detect	0.039	Minimum Non-Detect	-3.244
Maximum Non-Detect	0.048	Maximum Non-Detect	-3.037

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.942
5% Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean		0.0206
SD		0.00372
95% UTL	90% Coverage	0.0297
	95% UPL (t)	0.0279
	90% Percentile (z)	0.0254
	95% Percentile (z)	0.0267
	99% Percentile (z)	0.0293

Maximum Likelihood Estimate(MLE) Method N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)		-3.896
SD (Log Scale)		0.18
95% UTL	90% Coverage	0.0316
	95% UPL (t)	0.0289
	90% Percentile (z)	0.0256
	95% Percentile (z)	0.0273
	99% Percentile (z)	0.0309

Log ROS Method

Mean in Original Scale		0.0202
SD in Original Scale		0.00349
Mean in Log Scale		-3.915
SD in Log Scale		0.169
95% UTL	90% Coverage	0.0302
	95% UPL (t)	0.0278
	90% Percentile (z)	0.0248
	95% Percentile (z)	0.0263
	99% Percentile (z)	0.0295

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	13.22
Theta Star	0.00154
nu star	158.6
A-D Test Statistic	0.274
5% A-D Critical Value	0.697
K-S Test Statistic	0.207
5% K-S Critical Value	0.332

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0206
Median	0.021
SD	0.0035
k star	25.99
Theta star	0.000791
Nu star	467.8
95% Percentile of Chisquare (2k)	69.81
90% Percentile	0.0259
95% Percentile	0.0276
99% Percentile	0.0311

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0203
SD		0.00403
SE of Mean		0.0018
95% KM UTL with	90% Coverage	0.0302
95% KM Chebyshev UPL		0.0388
95% KM UPL (t)		0.0282
90% Percentile (z)		0.0255
95% Percentile (z)		0.027
99% Percentile (z)		0.0297

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.028
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0281
95% WH Approx. Gamma UTL with	90% Coverage	0.0302
95% HW Approx. Gamma UTL with	90% Coverage	0.0303

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Fluoranthene

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
Tolerance Factor	2.454	Percent Non-Detects	11.11%

Raw Statistics

Minimum Detected	0.015
Maximum Detected	0.043
Mean of Detected	0.0268
SD of Detected	0.00951
Minimum Non-Detect	0.04
Maximum Non-Detect	0.04

Log-transformed Statistics

Minimum Detected	-4.2
Maximum Detected	-3.147
Mean of Detected	-3.675
SD of Detected	0.348
Minimum Non-Detect	-3.219
Maximum Non-Detect	-3.219

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.931
5% Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean		0.026
SD		0.00918
95% UTL	90% Coverage	0.0485
	95% UPL (t)	0.044
	90% Percentile (z)	0.0378
	95% Percentile (z)	0.0411
	99% Percentile (z)	0.0474

Maximum Likelihood Estimate(MLE) Method N/A

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.974
5% Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)		-3.701
SD (Log Scale)		0.335
95% UTL	90% Coverage	0.0562
	95% UPL (t)	0.0477
	90% Percentile (z)	0.038
	95% Percentile (z)	0.0429
	99% Percentile (z)	0.0539

Log ROS Method

Mean in Original Scale		0.0264
SD in Original Scale		0.00896
Mean in Log Scale		-3.683
SD in Log Scale		0.327
95% UTL	90% Coverage	0.0561
	95% UPL (t)	0.0477
	90% Percentile (z)	0.0382
	95% Percentile (z)	0.0431
	99% Percentile (z)	0.0538

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	6.023
Theta Star	0.00444
nu star	96.36
A-D Test Statistic	0.231
5% A-D Critical Value	0.715
K-S Test Statistic	0.164
5% K-S Critical Value	0.294

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0267
Median	0.025
SD	0.0089
k star	7.187
Theta star	0.00372
Nu star	129.4
95% Percentile of Chisquare (2k)	24.18
90% Percentile	0.04
95% Percentile	0.0449
99% Percentile	0.0552

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0265
SD		0.00873
SE of Mean		0.00323
95% KM UTL with	90% Coverage	0.0479
95% KM Chebyshev UPL		0.0666
95% KM UPL (t)		0.0436
90% Percentile (z)		0.0377
95% Percentile (z)		0.0408
99% Percentile (z)		0.0468

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0464
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0468
95% WH Approx. Gamma UTL with	90% Coverage	0.0528
95% HW Approx. Gamma UTL with	90% Coverage	0.0536

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	1
Tolerance Factor	2.454	Percent Non-Detects	11.11%

Raw Statistics

Minimum Detected	0.015
Maximum Detected	0.03
Mean of Detected	0.021
SD of Detected	0.00593
Minimum Non-Detect	0.04
Maximum Non-Detect	0.04

Log-transformed Statistics

Minimum Detected	-4.2
Maximum Detected	-3.507
Mean of Detected	-3.895
SD of Detected	0.265
Minimum Non-Detect	-3.219
Maximum Non-Detect	-3.219

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.81
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.851
5% Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method		
	Mean	0.0209
	SD	0.00556
95% UTL	90% Coverage	0.0345
	95% UPL (t)	0.0318
	90% Percentile (z)	0.028
	95% Percentile (z)	0.03
	99% Percentile (z)	0.0338

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method		
	Mean (Log Scale)	-3.897
	SD (Log Scale)	0.248
95% UTL	90% Coverage	0.0373
	95% UPL (t)	0.033
	90% Percentile (z)	0.0279
	95% Percentile (z)	0.0305
	99% Percentile (z)	0.0362

Log ROS Method		
Mean in Original Scale		0.0209
SD in Original Scale		0.00555
Mean in Log Scale		-3.895
SD in Log Scale		0.248
95% UTL	90% Coverage	0.0374
	95% UPL (t)	0.0331
	90% Percentile (z)	0.028
	95% Percentile (z)	0.0306
	99% Percentile (z)	0.0362

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.912
Theta Star	0.00212
nu star	158.6
A-D Test Statistic	0.681
5% A-D Critical Value	0.716
K-S Test Statistic	0.265
5% K-S Critical Value	0.294

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0211
Median	0.021
SD	0.00555
k star	11.82
Theta star	0.00178
Nu star	212.8
95% Percentile of Chisquare (2k)	35.97
90% Percentile	0.0292
95% Percentile	0.0321
99% Percentile	0.0379

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.021
SD		0.00555
SE of Mean		0.0021
95% KM UTL with	90% Coverage	0.0346
95% KM Chebyshev UPL		0.0465
95% KM UPL (t)		0.0319
90% Percentile (z)		0.0281
95% Percentile (z)		0.0301
99% Percentile (z)		0.0339

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0328
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.033
95% WH Approx. Gamma UTL with	90% Coverage	0.0365
95% HW Approx. Gamma UTL with	90% Coverage	0.0368

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs

OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Naphthalene

General Statistics

Number of Valid Data	9	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	9

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Naphthalene was not processed!

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Phenanthrene

General Statistics

Number of Valid Data	9	Number of Detected Data	6
Number of Distinct Detected Data	4	Number of Non-Detect Data	3
Tolerance Factor	2.454	Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.014	Minimum Detected	-4.269
Maximum Detected	0.035	Maximum Detected	-3.352
Mean of Detected	0.0203	Mean of Detected	-3.965
SD of Detected	0.00878	SD of Detected	0.395
Minimum Non-Detect	0.047	Minimum Non-Detect	-3.058
Maximum Non-Detect	0.057	Maximum Non-Detect	-2.865

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.795
5% Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method		
Mean		0.022
SD		0.0075
95% UTL	90% Coverage	0.0404
	95% UPL (t)	0.0367
	90% Percentile (z)	0.0316
	95% Percentile (z)	0.0343
	99% Percentile (z)	0.0395

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.812
5% Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method		
Mean (Log Scale)		-3.87
SD (Log Scale)		0.347
95% UTL	90% Coverage	0.0489
	95% UPL (t)	0.0412
	90% Percentile (z)	0.0326
	95% Percentile (z)	0.0369
	99% Percentile (z)	0.0468

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000
Maximum Likelihood Estimate(MLE) Method	N/A

Log ROS Method	
Mean in Original Scale	0.0199
SD in Original Scale	0.00697
Mean in Log Scale	-3.965
SD in Log Scale	0.312
95% UTL 90% Coverage	0.0408
95% UPL (t)	0.035
90% Percentile (z)	0.0283
95% Percentile (z)	0.0317
99% Percentile (z)	0.0392

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.808
Theta Star	0.00534
nu star	45.7
A-D Test Statistic	0.645
5% A-D Critical Value	0.698
K-S Test Statistic	0.296
5% K-S Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0203
SD	0.00801
SE of Mean	0.00358
95% KM UTL with 90% Coverage	0.04
95% KM Chebyshev UPL	0.0572
95% KM UPL (t)	0.036
90% Percentile (z)	0.0306
95% Percentile (z)	0.0335
99% Percentile (z)	0.039

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data	
Mean	0.0207
Median	0.0213
SD	0.00696
k star	7.377
Theta star	0.0028
Nu star	132.8
95% Percentile of Chisquare (2k)	24.67
90% Percentile	0.0308
95% Percentile	0.0345
99% Percentile	0.0423

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0356
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0359
95% WH Approx. Gamma UTL with 90% Coverage	0.0405
95% HW Approx. Gamma UTL with 90% Coverage	0.0411

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Pyrene

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
Tolerance Factor	2.454	Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.016	Minimum Detected	-4.135
Maximum Detected	0.049	Maximum Detected	-3.016
Mean of Detected	0.0293	Mean of Detected	-3.606
SD of Detected	0.012	SD of Detected	0.413
Minimum Non-Detect	0.04	Minimum Non-Detect	-3.219
Maximum Non-Detect	0.04	Maximum Non-Detect	-3.219

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.926	Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution			Assuming Lognormal Distribution		
DL/2 Substitution Method			DL/2 Substitution Method		
Mean		0.0282	Mean (Log Scale)		-3.64
SD		0.0116	SD (Log Scale)		0.4
95% UTL	90% Coverage	0.0568	95% UTL	90% Coverage	0.07
	95% UPL (t)	0.0511		95% UPL (t)	0.0575
	90% Percentile (z)	0.0432		90% Percentile (z)	0.0438
	95% Percentile (z)	0.0474		95% Percentile (z)	0.0507
	99% Percentile (z)	0.0553		99% Percentile (z)	0.0665
Maximum Likelihood Estimate(MLE) Method		N/A	Log ROS Method		
			Mean in Original Scale		0.0286
			SD in Original Scale		0.0114
			Mean in Log Scale		-3.623
			SD in Log Scale		0.39
			95% UTL	90% Coverage	0.0695
				95% UPL (t)	0.0573
				90% Percentile (z)	0.044
				95% Percentile (z)	0.0507
				99% Percentile (z)	0.0661

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.402
Theta Star	0.00664
nu star	70.43
A-D Test Statistic	0.255
5% A-D Critical Value	0.718
K-S Test Statistic	0.166
5% K-S Critical Value	0.295

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.0289
Median	0.027
SD	0.0113
k star	5.201
Theta star	0.00556
Nu star	93.61
95% Percentile of Chisquare (2k)	18.86
90% Percentile	0.0459
95% Percentile	0.0524
99% Percentile	0.0662

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean		0.0286
SD		0.0109
SE of Mean		0.00398
95% KM UTL with	90% Coverage	0.0555
95% KM Chebyshev UPL		0.0789
95% KM UPL (t)		0.0501
90% Percentile (z)		0.0427
95% Percentile (z)		0.0466
99% Percentile (z)		0.0541

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		0.0545
95% Hawkins Wixley (HW) Approx. Gamma UPL		0.0552
95% WH Approx. Gamma UTL with	90% Coverage	0.0633
95% HW Approx. Gamma UTL with	90% Coverage	0.0647

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Formaldehyde

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
Tolerance Factor	3.407		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.11	Minimum	-2.207
Maximum	0.35	Maximum	-1.05
Second Largest	0.31	Second Largest	-1.171
First Quartile	0.22	First Quartile	-1.514
Median	0.22	Median	-1.514
Third Quartile	0.31	Third Quartile	-1.171
Mean	0.242	Mean	-1.491
Geometric Mean	0.225	SD	0.45
SD	0.0931		
Coefficient of Variation	0.385		
Skewness	-0.386		

Warning: There are only 4 Distinct Values in this data
There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Warning: A sample size of 'n' = 5 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.947	Shapiro Wilk Test Statistic	0.895
Shapiro Wilk Critical Value	0.762	Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	0.559	95% UTL with 90% Coverage	1.044
95% UPL (t)	0.459	95% UPL (t)	0.644
90% Percentile (z)	0.361	90% Percentile (z)	0.401
95% Percentile (z)	0.395	95% Percentile (z)	0.472
99% Percentile (z)	0.459	99% Percentile (z)	0.642

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test

k star	2.957
Theta Star	0.0818
MLE of Mean	0.242
MLE of Standard Deviation	0.141
nu star	29.57
A-D Test Statistic	0.345
5% A-D Critical Value	0.68
K-S Test Statistic	0.251
5% K-S Critical Value	0.358

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	0.431
95% Percentile	0.51
99% Percentile	0.682
95% WH Approx. Gamma UPL	0.547
95% HW Approx. Gamma UPL	0.566
95% WH Approx. Gamma UTL with 90% Coverage	0.757
95% HW Approx. Gamma UTL with 90% Coverage	0.806

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	0.334
95% Percentile	0.342
99% Percentile	0.348
95% UTL with 90% Coverage	0.35
95% Percentile Bootstrap UTL with 90% Coverage	0.35
95% BCA Bootstrap UTL with 90% Coverage	0.35
95% UPL	0.35
95% Chebyshev UPL	0.687
Upper Threshold Limit Based upon IQR	0.445

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	1400
Maximum	13000
Second Largest	12000
First Quartile	3200
Median	7100
Third Quartile	11000
Mean	7378
Geometric Mean	5726
SD	4541
Coefficient of Variation	0.616
Skewness	-0.143

Log-Transformed Statistics

Minimum	7.244
Maximum	9.473
Second Largest	9.393
First Quartile	8.071
Median	8.868
Third Quartile	9.306
Mean	8.653
SD	0.841

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.893
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	18522
95% UPL (t)	16279
90% Percentile (z)	13197
95% Percentile (z)	14847
99% Percentile (z)	17942

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.867
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	45097
95% UPL (t)	29769
90% Percentile (z)	16824
95% Percentile (z)	22836
99% Percentile (z)	40506

Gamma Distribution Test

k star	1.49
Theta Star	4951
MLE of Mean	7378
MLE of Standard Deviation	6044
nu star	26.83
A-D Test Statistic	0.509
5% A-D Critical Value	0.729
K-S Test Statistic	0.246
5% K-S Critical Value	0.282

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	15398
95% Percentile	19260
99% Percentile	27985
95% WH Approx. Gamma UPL	21345
95% HW Approx. Gamma UPL	22705
95% WH Approx. Gamma UTL with 90% Coverage	27191
95% HW Approx. Gamma UTL with 90% Coverage	29765

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	12200
95% Percentile	12600
99% Percentile	12920
95% UTL with 90% Coverage	13000
95% Percentile Bootstrap UTL with 90% Coverage	13000
95% BCA Bootstrap UTL with 90% Coverage	13000
95% UPL	13000
95% Chebyshev UPL	28243
Upper Threshold Limit Based upon IQR	22700

Table 2: ProUCL Output for Background Soil UPLs

OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.64	Minimum	-0.446
Maximum	10	Maximum	2.303
Second Largest	9.5	Second Largest	2.251
First Quartile	1.6	First Quartile	0.47
Median	4.7	Median	1.548
Third Quartile	6.8	Third Quartile	1.917
Mean	4.971	Mean	1.288
Geometric Mean	3.627	SD	0.952
SD	3.414		
Coefficient of Variation	0.687		
Skewness	0.248		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.899
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	13.35	95% UTL with 90% Coverage	37.52
95% UPL (t)	11.66	95% UPL (t)	23.44
90% Percentile (z)	9.346	90% Percentile (z)	12.29
95% Percentile (z)	10.59	95% Percentile (z)	17.36
99% Percentile (z)	12.91	99% Percentile (z)	33.23

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Gamma Distribution Test

k star	1.23
Theta Star	4.042
MLE of Mean	4.971
MLE of Standard Deviation	4.482
nu star	22.14
A-D Test Statistic	0.354
5% A-D Critical Value	0.732
K-S Test Statistic	0.195
5% K-S Critical Value	0.283

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	10.88
95% Percentile	13.85
99% Percentile	20.67
95% WH Approx. Gamma UPL	15.57
95% HW Approx. Gamma UPL	16.74
95% WH Approx. Gamma UTL with 90% Coverage	20.18
95% HW Approx. Gamma UTL with 90% Coverage	22.42

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	9.6
95% Percentile	9.8
99% Percentile	9.96
95% UTL with 90% Coverage	10
95% Percentile Bootstrap UTL with 90% Coverage	10
95% BCA Bootstrap UTL with 90% Coverage	10
95% UPL	10
95% Chebyshev UPL	20.66
Upper Threshold Limit Based upon IQR	14.6

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
Tolerance Factor	2.454		

Raw Statistics

Minimum	3.5
Maximum	15
Second Largest	13
First Quartile	8.5
Median	12
Third Quartile	13
Mean	10.19
Geometric Mean	9.356
SD	3.809
Coefficient of Variation	0.374
Skewness	-0.699

Log-Transformed Statistics

Minimum	1.253
Maximum	2.708
Second Largest	2.565
First Quartile	2.14
Median	2.485
Third Quartile	2.565
Mean	2.236
SD	0.477

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	19.54
95% UPL (t)	17.66
90% Percentile (z)	15.07
95% Percentile (z)	16.45
99% Percentile (z)	19.05

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.851
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	30.18
95% UPL (t)	23.84
90% Percentile (z)	17.25
95% Percentile (z)	20.51
99% Percentile (z)	28.39

Gamma Distribution Test

k star	4.093
Theta Star	2.49
MLE of Mean	10.19
MLE of Standard Deviation	5.037
nu star	73.67
A-D Test Statistic	0.555
5% A-D Critical Value	0.723
K-S Test Statistic	0.263
5% K-S Critical Value	0.28

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	16.94
95% Percentile	19.63
99% Percentile	25.37
95% WH Approx. Gamma UPL	20.6
95% HW Approx. Gamma UPL	21.22
95% WH Approx. Gamma UTL with 90% Coverage	24.27
95% HW Approx. Gamma UTL with 90% Coverage	25.35

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	13.4
95% Percentile	14.2
99% Percentile	14.84
95% UTL with 90% Coverage	15
95% Percentile Bootstrap UTL with 90% Coverage	15
95% BCA Bootstrap UTL with 90% Coverage	15
95% UPL	15
95% Chebyshev UPL	27.69
Upper Threshold Limit Based upon IQR	19.75

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Beryllium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	0.042
Maximum	0.32
Second Largest	0.3
First Quartile	0.18
Median	0.19
Third Quartile	0.29
Mean	0.208
Geometric Mean	0.178
SD	0.0981
Coefficient of Variation	0.472
Skewness	-0.546

Log-Transformed Statistics

Minimum	-3.17
Maximum	-1.139
Second Largest	-1.204
First Quartile	-1.715
Median	-1.661
Third Quartile	-1.238
Mean	-1.729
SD	0.677

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.905
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.82
Shapiro Wilk Critical Value	0.829

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	0.448
95% UPL (t)	0.4
90% Percentile (z)	0.333
95% Percentile (z)	0.369
99% Percentile (z)	0.436

Assuming Lognormal Distribution

95% UTL with 90% Coverage	0.934
95% UPL (t)	0.669
90% Percentile (z)	0.423
95% Percentile (z)	0.54
99% Percentile (z)	0.857

Gamma Distribution Test

k star	2.307
Theta Star	0.09
MLE of Mean	0.208
MLE of Standard Deviation	0.137
nu star	41.52
A-D Test Statistic	0.606
5% A-D Critical Value	0.726
K-S Test Statistic	0.25
5% K-S Critical Value	0.281

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	0.304
95% Percentile	0.312
99% Percentile	0.318

Assuming Gamma Distribution

90% Percentile	0.391
95% Percentile	0.471
99% Percentile	0.648
95% WH Approx. Gamma UPL	0.507
95% HW Approx. Gamma UPL	0.534
95% WH Approx. Gamma UTL with 90% Coverage	0.622
95% HW Approx. Gamma UTL with 90% Coverage	0.67

95% UTL with 90% Coverage	0.32
95% Percentile Bootstrap UTL with 90% Coverage	0.32
95% BCA Bootstrap UTL with 90% Coverage	0.32
95% UPL	0.32
95% Chebyshev UPL	0.658
Upper Threshold Limit Based upon IQR	0.455

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.037	Minimum	-3.297
Maximum	0.26	Maximum	-1.347
Second Largest	0.23	Second Largest	-1.47
First Quartile	0.057	First Quartile	-2.865
Median	0.16	Median	-1.833
Third Quartile	0.22	Third Quartile	-1.514
Mean	0.151	Mean	-2.1
Geometric Mean	0.122	SD	0.745
SD	0.0867		
Coefficient of Variation	0.575		
Skewness	-0.197		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Test Statistic	0.855
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	0.364	95% UTL with 90% Coverage	0.762
95% UPL (t)	0.321	95% UPL (t)	0.528
90% Percentile (z)	0.262	90% Percentile (z)	0.318
95% Percentile (z)	0.293	95% Percentile (z)	0.417
99% Percentile (z)	0.352	99% Percentile (z)	0.693

Gamma Distribution Test		**Data Distribution Test**
k star	1.782	**Data appear Normal at 5% Significance Level**
Theta Star	0.0846	
MLE of Mean	0.151	
MLE of Standard Deviation	0.113	
nu star	32.07	
A-D Test Statistic	0.609	
5% A-D Critical Value	0.728	
K-S Test Statistic	0.246	
5% K-S Critical Value	0.282	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	0.236
95% Percentile	0.248
99% Percentile	0.258

Assuming Gamma Distribution			
90% Percentile	0.301	95% UTL with 90% Coverage	0.26
95% Percentile	0.371	95% Percentile Bootstrap UTL with 90% Coverage	0.26
99% Percentile	0.527	95% BCA Bootstrap UTL with 90% Coverage	0.26
		95% UPL	0.26
95% WH Approx. Gamma UPL	0.406	95% Chebyshev UPL	0.549
95% HW Approx. Gamma UPL	0.427	Upper Threshold Limit Based upon IQR	0.465
95% WH Approx. Gamma UTL with 90% Coverage	0.509		
95% HW Approx. Gamma UTL with 90% Coverage	0.549		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Calcium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	86	Minimum	4.454
Maximum	590	Maximum	6.38
Second Largest	480	Second Largest	6.174
First Quartile	320	First Quartile	5.768
Median	390	Median	5.966
Third Quartile	480	Third Quartile	6.174
Mean	368.4	Mean	5.782
Geometric Mean	324.5	SD	0.605
SD	158.9		
Coefficient of Variation	0.431		
Skewness	-0.6		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.95	Shapiro Wilk Test Statistic	0.834
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	758.3	95% UTL with 90% Coverage	1433
95% UPL (t)	679.9	95% UPL (t)	1063
90% Percentile (z)	572.1	90% Percentile (z)	704.8
95% Percentile (z)	629.8	95% Percentile (z)	878.1
99% Percentile (z)	738	99% Percentile (z)	1326

Gamma Distribution Test		**Data Distribution Test**
k star	2.803	**Data appear Normal at 5% Significance Level**
Theta Star	131.4	
MLE of Mean	368.4	
MLE of Standard Deviation	220.1	
nu star	50.45	
A-D Test Statistic	0.536	
5% A-D Critical Value	0.725	
K-S Test Statistic	0.233	
5% K-S Critical Value	0.28	

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
90% Percentile	502
95% Percentile	546
99% Percentile	581.2

Assuming Gamma Distribution			
90% Percentile	663.5	95% UTL with 90% Coverage	590
95% Percentile	788.6	95% Percentile Bootstrap UTL with 90% Coverage	590
99% Percentile	1061	95% BCA Bootstrap UTL with 90% Coverage	590
		95% UPL	590
		95% Chebyshev UPL	1098
95% WH Approx. Gamma UPL	839.5	Upper Threshold Limit Based upon IQR	720
95% HW Approx. Gamma UPL	878.7		
95% WH Approx. Gamma UTL with 90% Coverage	1015		
95% HW Approx. Gamma UTL with 90% Coverage	1083		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	1.5	Minimum	0.405
Maximum	10	Maximum	2.303
Second Largest	9.7	Second Largest	2.272
First Quartile	4	First Quartile	1.386
Median	6	Median	1.792
Third Quartile	9.1	Third Quartile	2.208
Mean	6.167	Mean	1.624
Geometric Mean	5.075	SD	0.733
SD	3.379		
Coefficient of Variation	0.548		
Skewness	-0.251		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.886	Shapiro Wilk Test Statistic	0.844
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	14.46	95% UTL with 90% Coverage	30.65
95% UPL (t)	12.79	95% UPL (t)	21.34
90% Percentile (z)	10.5	90% Percentile (z)	12.98
95% Percentile (z)	11.72	95% Percentile (z)	16.94
99% Percentile (z)	14.03	99% Percentile (z)	27.91

Gamma Distribution Test		**Data Distribution Test**
k star	1.889	**Data appear Normal at 5% Significance Level**
Theta Star	3.265	
MLE of Mean	6.167	
MLE of Standard Deviation	4.487	
nu star	34	
A-D Test Statistic	0.546	
5% A-D Critical Value	0.728	
K-S Test Statistic	0.239	
5% K-S Critical Value	0.282	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	9.76
95% Percentile	9.88
99% Percentile	9.976

Assuming Gamma Distribution			
90% Percentile	12.16	95% UTL with 90% Coverage	10
95% Percentile	14.9	95% Percentile Bootstrap UTL with 90% Coverage	10
99% Percentile	20.99	95% BCA Bootstrap UTL with 90% Coverage	10
		95% UPL	10
95% WH Approx. Gamma UPL	16.23	95% Chebyshev UPL	21.69
95% HW Approx. Gamma UPL	17.1	Upper Threshold Limit Based upon IQR	16.75
95% WH Approx. Gamma UTL with 90% Coverage	20.25		
95% HW Approx. Gamma UTL with 90% Coverage	21.86		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	0.45
Maximum	2.9
Second Largest	2.3
First Quartile	0.56
Median	2
Third Quartile	2.3
Mean	1.559
Geometric Mean	1.252
SD	0.944
Coefficient of Variation	0.606
Skewness	-0.0605

Log-Transformed Statistics

Minimum	-0.799
Maximum	1.065
Second Largest	0.833
First Quartile	-0.58
Median	0.693
Third Quartile	0.833
Mean	0.224
SD	0.753

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.862
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	3.876
95% UPL (t)	3.41
90% Percentile (z)	2.769
95% Percentile (z)	3.112
99% Percentile (z)	3.756

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.833
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	7.941
95% UPL (t)	5.475
90% Percentile (z)	3.285
95% Percentile (z)	4.318
99% Percentile (z)	7.213

Gamma Distribution Test

k star	1.695
Theta Star	0.92
MLE of Mean	1.559
MLE of Standard Deviation	1.198
nu star	30.5
A-D Test Statistic	0.744
5% A-D Critical Value	0.728
K-S Test Statistic	0.287
5% K-S Critical Value	0.282

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	3.154
95% Percentile	3.9
99% Percentile	5.572
95% WH Approx. Gamma UPL	4.283
95% HW Approx. Gamma UPL	4.494
95% WH Approx. Gamma UTL with 90% Coverage	5.398
95% HW Approx. Gamma UTL with 90% Coverage	5.804

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	2.42
95% Percentile	2.66
99% Percentile	2.852
95% UTL with 90% Coverage	2.9
95% Percentile Bootstrap UTL with 90% Coverage	2.9
95% BCA Bootstrap UTL with 90% Coverage	2.9
95% UPL	2.9
95% Chebyshev UPL	5.897
Upper Threshold Limit Based upon IQR	4.91

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	1.7
Maximum	5.8
Second Largest	5.6
First Quartile	3.6
Median	4.1
Third Quartile	5.3
Mean	4.144
Geometric Mean	3.922
SD	1.303
Coefficient of Variation	0.314
Skewness	-0.49

Log-Transformed Statistics

Minimum	0.531
Maximum	1.758
Second Largest	1.723
First Quartile	1.281
Median	1.411
Third Quartile	1.668
Mean	1.367
SD	0.377

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	7.342
95% UPL (t)	6.698
90% Percentile (z)	5.814
95% Percentile (z)	6.288
99% Percentile (z)	7.176

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.868
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	9.89
95% UPL (t)	8.21
90% Percentile (z)	6.358
95% Percentile (z)	7.29
99% Percentile (z)	9.426

Gamma Distribution Test

k star	6.227
Theta Star	0.666
MLE of Mean	4.144
MLE of Standard Deviation	1.661
nu star	112.1
A-D Test Statistic	0.416
5% A-D Critical Value	0.722
K-S Test Statistic	0.168
5% K-S Critical Value	0.279

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	6.364
95% Percentile	7.199
99% Percentile	8.948
95% WH Approx. Gamma UPL	7.456
95% HW Approx. Gamma UPL	7.609
95% WH Approx. Gamma UTL with 90% Coverage	8.563
95% HW Approx. Gamma UTL with 90% Coverage	8.821

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	5.64
95% Percentile	5.72
99% Percentile	5.784
95% UTL with 90% Coverage	5.8
95% Percentile Bootstrap UTL with 90% Coverage	5.8
95% BCA Bootstrap UTL with 90% Coverage	5.8
95% UPL	5.8
95% Chebyshev UPL	10.13
Upper Threshold Limit Based upon IQR	7.85

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	610	Minimum	6.413
Maximum	12000	Maximum	9.393
Second Largest	11000	Second Largest	9.306
First Quartile	760	First Quartile	6.633
Median	6600	Median	8.795
Third Quartile	10000	Third Quartile	9.21
Mean	6314	Mean	8.223
Geometric Mean	3727	SD	1.31
SD	4719		
Coefficient of Variation	0.747		
Skewness	-0.233		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.855	Shapiro Wilk Test Statistic	0.764
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	17894	95% UTL with 90% Coverage	92740
95% UPL (t)	15564	95% UPL (t)	48566
90% Percentile (z)	12362	90% Percentile (z)	19967
95% Percentile (z)	14076	95% Percentile (z)	32136
99% Percentile (z)	17292	99% Percentile (z)	78461

Gamma Distribution Test		**Data Distribution Test**
k star	0.797	**Data appear Normal at 5% Significance Level**
Theta Star	7922	
MLE of Mean	6314	
MLE of Standard Deviation	7073	
nu star	14.35	
A-D Test Statistic	0.902	
5% A-D Critical Value	0.742	
K-S Test Statistic	0.241	
5% K-S Critical Value	0.286	

Data follow Appx. Gamma Distribution at 5% Significance Leve

Nonparametric Statistics	
90% Percentile	11200
95% Percentile	11600
99% Percentile	11920

Assuming Gamma Distribution			
90% Percentile	15368	95% UTL with 90% Coverage	12000
95% Percentile	20511	95% Percentile Bootstrap UTL with 90% Coverage	12000
99% Percentile	32660	95% BCA Bootstrap UTL with 90% Coverage	12000
		95% UPL	12000
95% WH Approx. Gamma UPL	24202	95% Chebyshev UPL	27996
95% HW Approx. Gamma UPL	27175	Upper Threshold Limit Based upon IQR	23860
95% WH Approx. Gamma UTL with 90% Coverage	32759		
95% HW Approx. Gamma UTL with 90% Coverage	38599		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	7.8	Minimum	2.054
Maximum	26	Maximum	3.258
Second Largest	22	Second Largest	3.091
First Quartile	11	First Quartile	2.398
Median	14	Median	2.639
Third Quartile	20	Third Quartile	2.996
Mean	15.62	Mean	2.677
Geometric Mean	14.54	SD	0.406
SD	6.179		
Coefficient of Variation	0.395		
Skewness	0.441		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	30.78	95% UTL with 90% Coverage	39.35
95% UPL (t)	27.73	95% UPL (t)	32.2
90% Percentile (z)	23.54	90% Percentile (z)	24.46
95% Percentile (z)	25.79	95% Percentile (z)	28.34
99% Percentile (z)	30	99% Percentile (z)	37.36

Gamma Distribution Test		**Data Distribution Test**
k star	4.836	**Data appear Normal at 5% Significance Level**
Theta Star	3.23	
MLE of Mean	15.62	
MLE of Standard Deviation	7.104	
nu star	87.05	
A-D Test Statistic	0.227	
5% A-D Critical Value	0.722	
K-S Test Statistic	0.152	
5% K-S Critical Value	0.28	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	22.8
95% Percentile	24.4
99% Percentile	25.68

Assuming Gamma Distribution			
90% Percentile	25.13	95% UTL with 90% Coverage	26
95% Percentile	28.84	95% Percentile Bootstrap UTL with 90% Coverage	26
99% Percentile	36.67	95% BCA Bootstrap UTL with 90% Coverage	26
		95% UPL	26
95% WH Approx. Gamma UPL	30.07	95% Chebyshev UPL	44.01
95% HW Approx. Gamma UPL	30.52	Upper Threshold Limit Based upon IQR	33.5
95% WH Approx. Gamma UTL with 90% Coverage	35.07		
95% HW Approx. Gamma UTL with 90% Coverage	35.93		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Magnesium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	24	Minimum	3.178
Maximum	1100	Maximum	7.003
Second Largest	780	Second Largest	6.659
First Quartile	48	First Quartile	3.871
Median	520	Median	6.254
Third Quartile	740	Third Quartile	6.607
Mean	451.7	Mean	5.429
Geometric Mean	227.9	SD	1.509
SD	389.3		
Coefficient of Variation	0.862		
Skewness	0.288		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.907	Shapiro Wilk Test Statistic	0.84
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	1407	95% UTL with 90% Coverage	9253
95% UPL (t)	1215	95% UPL (t)	4391
90% Percentile (z)	950.6	90% Percentile (z)	1577
95% Percentile (z)	1092	95% Percentile (z)	2728
99% Percentile (z)	1357	99% Percentile (z)	7631

Gamma Distribution Test		**Data Distribution Test**
k star	0.647	**Data appear Normal at 5% Significance Level**
Theta Star	698	
MLE of Mean	451.7	
MLE of Standard Deviation	561.5	
nu star	11.65	
A-D Test Statistic	0.585	**Nonparametric Statistics**
5% A-D Critical Value	0.748	90% Percentile 844
K-S Test Statistic	0.245	95% Percentile 972
5% K-S Critical Value	0.288	99% Percentile 1074

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution			
90% Percentile	1155	95% UTL with 90% Coverage	1100
95% Percentile	1582	95% Percentile Bootstrap UTL with 90% Coverage	1100
99% Percentile	2607	95% BCA Bootstrap UTL with 90% Coverage	1100
		95% UPL	1100
95% WH Approx. Gamma UPL	1906	95% Chebyshev UPL	2241
95% HW Approx. Gamma UPL	2171	Upper Threshold Limit Based upon IQR	1778
95% WH Approx. Gamma UTL with 90% Coverage	2639		
95% HW Approx. Gamma UTL with 90% Coverage	3178		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	3.4	Minimum	1.224
Maximum	69	Maximum	4.234
Second Largest	60	Second Largest	4.094
First Quartile	7.5	First Quartile	2.015
Median	25	Median	3.219
Third Quartile	38	Third Quartile	3.638
Mean	27.97	Mean	2.865
Geometric Mean	17.56	SD	1.136
SD	24.15		
Coefficient of Variation	0.864		
Skewness	0.709		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk Test Statistic	0.916
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	87.23	95% UTL with 90% Coverage	284.9
95% UPL (t)	75.31	95% UPL (t)	162.6
90% Percentile (z)	58.92	90% Percentile (z)	75.25
95% Percentile (z)	67.69	95% Percentile (z)	113.7
99% Percentile (z)	84.15	99% Percentile (z)	246.5

Gamma Distribution Test		**Data Distribution Test**
k star	0.883	**Data appear Normal at 5% Significance Level**
Theta Star	31.67	
MLE of Mean	27.97	
MLE of Standard Deviation	29.76	
nu star	15.9	
A-D Test Statistic	0.284	**Nonparametric Statistics**
5% A-D Critical Value	0.74	90% Percentile 61.8
K-S Test Statistic	0.14	95% Percentile 65.4
5% K-S Critical Value	0.286	99% Percentile 68.28

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution			
90% Percentile	66.39	95% UTL with 90% Coverage	69
95% Percentile	87.56	95% Percentile Bootstrap UTL with 90% Coverage	69
99% Percentile	137.2	95% BCA Bootstrap UTL with 90% Coverage	69
		95% UPL	69
95% WH Approx. Gamma UPL	101.3	95% Chebyshev UPL	138.9
95% HW Approx. Gamma UPL	109.8	Upper Threshold Limit Based upon IQR	83.75
95% WH Approx. Gamma UTL with 90% Coverage	135.9		
95% HW Approx. Gamma UTL with 90% Coverage	153.3		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Tolerance Factor	2.755		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.048	Minimum	-3.037
Maximum	0.11	Maximum	-2.207
Second Largest	0.083	Second Largest	-2.489
First Quartile	0.0515	First Quartile	-2.968
Median	0.064	Median	-2.749
Third Quartile	0.0785	Third Quartile	-2.546
Mean	0.0689	Mean	-2.717
Geometric Mean	0.066	SD	0.306
SD	0.0224		
Coefficient of Variation	0.325		
Skewness	1.076		

Warning: A sample size of 'n' = 7 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 7 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk Test Statistic	0.931
Shapiro Wilk Critical Value	0.803	Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	0.131	95% UTL with 90% Coverage	0.154
95% UPL (t)	0.115	95% UPL (t)	0.125
90% Percentile (z)	0.0975	90% Percentile (z)	0.0978
95% Percentile (z)	0.106	95% Percentile (z)	0.109
99% Percentile (z)	0.121	99% Percentile (z)	0.135

Gamma Distribution Test		**Data Distribution Test**
k star	7.033	**Data appear Normal at 5% Significance Level**
Theta Star	0.00979	
MLE of Mean	0.0689	
MLE of Standard Deviation	0.026	
nu star	98.46	
A-D Test Statistic	0.294	
5% A-D Critical Value	0.708	
K-S Test Statistic	0.173	
5% K-S Critical Value	0.312	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	0.0938
95% Percentile	0.102
99% Percentile	0.108

Assuming Gamma Distribution			
90% Percentile	0.104	95% UTL with 90% Coverage	0.11
95% Percentile	0.116	95% Percentile Bootstrap UTL with 90% Coverage	0.11
99% Percentile	0.143	95% BCA Bootstrap UTL with 90% Coverage	0.11
		95% UPL	0.11
95% WH Approx. Gamma UPL	0.121	95% Chebyshev UPL	0.173
95% HW Approx. Gamma UPL	0.122	Upper Threshold Limit Based upon IQR	0.119
95% WH Approx. Gamma UTL with 90% Coverage	0.143		
95% HW Approx. Gamma UTL with 90% Coverage	0.145		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
Tolerance Factor	2.454		

Raw Statistics

Minimum	1.3
Maximum	7.3
Second Largest	5.8
First Quartile	1.7
Median	3.9
Third Quartile	5.8
Mean	3.989
Geometric Mean	3.339
SD	2.261
Coefficient of Variation	0.567
Skewness	0.0778

Log-Transformed Statistics

Minimum	0.262
Maximum	1.988
Second Largest	1.758
First Quartile	0.531
Median	1.361
Third Quartile	1.758
Mean	1.206
SD	0.668

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.887
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.874
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	9.537
95% UPL (t)	8.42
90% Percentile (z)	6.886
95% Percentile (z)	7.708
99% Percentile (z)	9.248

Assuming Lognormal Distribution

95% UTL with 90% Coverage	17.19
95% UPL (t)	12.36
90% Percentile (z)	7.857
95% Percentile (z)	10.01
99% Percentile (z)	15.79

Gamma Distribution Test

k star	2.052
Theta Star	1.944
MLE of Mean	3.989
MLE of Standard Deviation	2.785
nu star	36.93
A-D Test Statistic	0.55
5% A-D Critical Value	0.727
K-S Test Statistic	0.254
5% K-S Critical Value	0.281

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	6.1
95% Percentile	6.7
99% Percentile	7.18

Assuming Gamma Distribution

90% Percentile	7.711
95% Percentile	9.385
99% Percentile	13.09
95% WH Approx. Gamma UPL	10.17
95% HW Approx. Gamma UPL	10.57
95% WH Approx. Gamma UTL with 90% Coverage	12.61
95% HW Approx. Gamma UTL with 90% Coverage	13.39

95% UTL with 90% Coverage	7.3
95% Percentile Bootstrap UTL with 90% Coverage	7.3
95% BCA Bootstrap UTL with 90% Coverage	7.3
95% UPL	7.3
95% Chebyshev UPL	14.38
Upper Threshold Limit Based upon IQR	11.95

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Potassium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	51
Maximum	580
Second Largest	520
First Quartile	210
Median	400
Third Quartile	440
Mean	351.2
Geometric Mean	294
SD	168.9
Coefficient of Variation	0.481
Skewness	-0.488

Log-Transformed Statistics

Minimum	3.932
Maximum	6.363
Second Largest	6.254
First Quartile	5.347
Median	5.991
Third Quartile	6.087
Mean	5.684
SD	0.749

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.804
Shapiro Wilk Critical Value	0.829

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with	90% Coverage	765.8
	95% UPL (t)	682.3
	90% Percentile (z)	567.7
	95% Percentile (z)	629.1
	99% Percentile (z)	744.2

Assuming Lognormal Distribution

95% UTL with	90% Coverage	1849
	95% UPL (t)	1277
	90% Percentile (z)	768.1
	95% Percentile (z)	1008
	99% Percentile (z)	1680

Gamma Distribution Test

k star	2.054
Theta Star	171
MLE of Mean	351.2
MLE of Standard Deviation	245.1
nu star	36.97
A-D Test Statistic	0.524
5% A-D Critical Value	0.727
K-S Test Statistic	0.219
5% K-S Critical Value	0.281

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	532
95% Percentile	556
99% Percentile	575.2

Assuming Gamma Distribution

90% Percentile		678.8
95% Percentile		826.1
99% Percentile		1152
95% WH Approx. Gamma UPL		892.4
95% HW Approx. Gamma UPL		952
95% WH Approx. Gamma UTL with	90% Coverage	1104
95% HW Approx. Gamma UTL with	90% Coverage	1208

95% UTL with	90% Coverage	580
95% Percentile Bootstrap UTL with	90% Coverage	580
95% BCA Bootstrap UTL with	90% Coverage	580
	95% UPL	580
	95% Chebyshev UPL	1127
Upper Threshold Limit Based upon IQR		785

Table 2: ProUCL Output for Background Soil UPLs

OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Selenium

General Statistics

Number of Valid Data	9	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	7

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful and reliable test statistics and estimates.
No statistics will be produced!

Tolerance Factor	2.454	Percent Non-Detects	77.78%

Raw Statistics

Minimum Detected	0.39
Maximum Detected	0.6
Mean of Detected	0.495
SD of Detected	0.148
Minimum Non-Detect	0.61
Maximum Non-Detect	0.9

Log-transformed Statistics

Minimum Detected	-0.942
Maximum Detected	-0.511
Mean of Detected	-0.726
SD of Detected	0.305
Minimum Non-Detect	-0.494
Maximum Non-Detect	-0.105

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method		
Mean		0.409
SD		0.0869
95% UTL	90% Coverage	0.623
	95% UPL (t)	0.58
	90% Percentile (z)	0.521
	95% Percentile (z)	0.552
	99% Percentile (z)	0.612

Assuming Lognormal Distribution

DL/2 Substitution Method		
Mean (Log Scale)		-0.911
SD (Log Scale)		0.201
95% UTL	90% Coverage	0.658
	95% UPL (t)	0.596
	90% Percentile (z)	0.52
	95% Percentile (z)	0.559
	99% Percentile (z)	0.641

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000
Maximum Likelihood Estimate(MLE) Method	N/A

Log ROS Method	
Mean in Original Scale	N/A
SD in Original Scale	N/A
Mean in Log Scale	N/A
SD in Log Scale	N/A
95% UTL 90% Coverage	N/A
95% UPL (t)	N/A
90% Percentile (z)	N/A
95% Percentile (z)	N/A
99% Percentile (z)	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data	
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
95% Percentile of Chisquare (2k)	N/A
90% Percentile	N/A
95% Percentile	N/A
99% Percentile	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.495
SD	0.105
SE of Mean	0.105
95% KM UTL with 90% Coverage	0.753
95% KM Chebyshev UPL	0.977
95% KM UPL (t)	0.701
90% Percentile (z)	0.63
95% Percentile (z)	0.668
99% Percentile (z)	0.739

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	N/A
95% Hawkins Wixley (HW) Approx. Gamma UPL	N/A
95% WH Approx. Gamma UTL with 90% Coverage	N/A
95% HW Approx. Gamma UTL with 90% Coverage	N/A

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Silver

General Statistics

Number of Valid Data	9	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	9

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Silver was not processed!

Sodium

General Statistics

Number of Valid Data	9	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Tolerance Factor	2.454	Percent Non-Detects	55.56%

Raw Statistics

Minimum Detected	33
Maximum Detected	48
Mean of Detected	39.25
SD of Detected	6.344
Minimum Non-Detect	120
Maximum Non-Detect	170

Log-transformed Statistics

Minimum Detected	3.497
Maximum Detected	3.871
Mean of Detected	3.661
SD of Detected	0.157
Minimum Non-Detect	4.787
Maximum Non-Detect	5.136

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	9
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.938
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.962
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Assuming Normal Distribution

DL/2 Substitution Method		
Mean		57.44
SD		18.99
95% UTL	90% Coverage	104
95% UPL (t)		94.66
90% Percentile (z)		81.78
95% Percentile (z)		88.68
99% Percentile (z)		101.6
Maximum Likelihood Estimate(MLE) Method		N/A

Assuming Lognormal Distribution

DL/2 Substitution Method		
Mean (Log Scale)		3.999
SD (Log Scale)		0.348
95% UTL	90% Coverage	128.2
95% UPL (t)		108
90% Percentile (z)		85.23
95% Percentile (z)		96.73
99% Percentile (z)		122.7
Log ROS Method		
Mean in Original Scale		39.08
SD in Original Scale		4.279
Mean in Log Scale		3.661
SD in Log Scale		0.106
95% UTL	90% Coverage	50.48
95% UPL (t)		47.9
90% Percentile (z)		44.56
95% Percentile (z)		46.32
99% Percentile (z)		49.8

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	13.5
Theta Star	2.907
nu star	108
A-D Test Statistic	0.281
5% A-D Critical Value	0.656
K-S Test Statistic	0.25
5% K-S Critical Value	0.394

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method		
Mean		39.25
SD		5.494
SE of Mean		3.172
95% KM UTL with	90% Coverage	52.73
95% KM Chebyshev UPL		64.49
95% KM UPL (t)		50.02
90% Percentile (z)		46.29
95% Percentile (z)		48.29
99% Percentile (z)		52.03

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data		
Mean		39.62
Median		40.08
SD		4.284
k star		65.5
Theta star		0.605
Nu star		1179
95% Percentile of Chisquare (2k)		158.7
90% Percentile		46.01
95% Percentile		48
99% Percentile		51.89

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL		48.37
95% Hawkins Wixley (HW) Approx. Gamma UPL		48.43
95% WH Approx. Gamma UTL with	90% Coverage	50.81
95% HW Approx. Gamma UTL with	90% Coverage	50.91

Note: DL/2 is not a recommended method.

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Tin

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics

Minimum	0.71
Maximum	3.5
Second Largest	3.4
First Quartile	1.6
Median	2.2
Third Quartile	3.2
Mean	2.254
Geometric Mean	1.948
SD	1.115
Coefficient of Variation	0.495
Skewness	-0.257

Log-Transformed Statistics

Minimum	-0.342
Maximum	1.253
Second Largest	1.224
First Quartile	0.47
Median	0.788
Third Quartile	1.163
Mean	0.667
SD	0.62

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.875
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	4.991
95% UPL (t)	4.44
90% Percentile (z)	3.684
95% Percentile (z)	4.089
99% Percentile (z)	4.849

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.847
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	8.919
95% UPL (t)	6.566
90% Percentile (z)	4.311
95% Percentile (z)	5.401
99% Percentile (z)	8.24

Gamma Distribution Test

k star	2.461
Theta Star	0.916
MLE of Mean	2.254
MLE of Standard Deviation	1.437
nu star	44.29
A-D Test Statistic	0.569
5% A-D Critical Value	0.726
K-S Test Statistic	0.254
5% K-S Critical Value	0.281

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	4.18
95% Percentile	5.016
99% Percentile	6.847
95% WH Approx. Gamma UPL	5.381
95% HW Approx. Gamma UPL	5.598
95% WH Approx. Gamma UTL with 90% Coverage	6.575
95% HW Approx. Gamma UTL with 90% Coverage	6.973

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	3.42
95% Percentile	3.46
99% Percentile	3.492
95% UTL with 90% Coverage	3.5
95% Percentile Bootstrap UTL with 90% Coverage	3.5
95% BCA Bootstrap UTL with 90% Coverage	3.5
95% UPL	3.5
95% Chebyshev UPL	7.379
Upper Threshold Limit Based upon IQR	5.6

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics

Minimum	3.6
Maximum	21
Second Largest	19
First Quartile	5
Median	13
Third Quartile	16
Mean	11.93
Geometric Mean	9.928
SD	6.555
Coefficient of Variation	0.549
Skewness	-0.146

Log-Transformed Statistics

Minimum	1.281
Maximum	3.045
Second Largest	2.944
First Quartile	1.609
Median	2.565
Third Quartile	2.773
Mean	2.295
SD	0.697

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	28.02
95% UPL (t)	24.78
90% Percentile (z)	20.33
95% Percentile (z)	22.72
99% Percentile (z)	27.18

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.852
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	54.9
95% UPL (t)	38.92
90% Percentile (z)	24.25
95% Percentile (z)	31.24
99% Percentile (z)	50.23

Gamma Distribution Test

k star	1.989
Theta Star	5.999
MLE of Mean	11.93
MLE of Standard Deviation	8.461
nu star	35.81
A-D Test Statistic	0.553
5% A-D Critical Value	0.727
K-S Test Statistic	0.193
5% K-S Critical Value	0.281

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	23.24
95% Percentile	28.35
99% Percentile	39.7
95% WH Approx. Gamma UPL	30.8
95% HW Approx. Gamma UPL	32.25
95% WH Approx. Gamma UTL with 90% Coverage	38.29
95% HW Approx. Gamma UTL with 90% Coverage	40.99

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	19.4
95% Percentile	20.2
99% Percentile	20.84
95% UTL with 90% Coverage	21
95% Percentile Bootstrap UTL with 90% Coverage	21
95% BCA Bootstrap UTL with 90% Coverage	21
95% UPL	21
95% Chebyshev UPL	42.05
Upper Threshold Limit Based upon IQR	32.5

Table 2: ProUCL Output for Background Soil UPLs

OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	1.9	Minimum	0.642
Maximum	18	Maximum	2.89
Second Largest	14	Second Largest	2.639
First Quartile	5	First Quartile	1.609
Median	6.1	Median	1.808
Third Quartile	13	Third Quartile	2.565
Mean	8.533	Mean	1.896
Geometric Mean	6.659	SD	0.803
SD	5.664		
Coefficient of Variation	0.664		
Skewness	0.43		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Test Statistic	0.919
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	22.43	95% UTL with 90% Coverage	47.78
95% UPL (t)	19.64	95% UPL (t)	32.14
90% Percentile (z)	15.79	90% Percentile (z)	18.64
95% Percentile (z)	17.85	95% Percentile (z)	24.95
99% Percentile (z)	21.71	99% Percentile (z)	43.13

Gamma Distribution Test		**Data Distribution Test**
k star	1.519	**Data appear Normal at 5% Significance Level**
Theta Star	5.618	
MLE of Mean	8.533	
MLE of Standard Deviation	6.924	
nu star	27.34	
A-D Test Statistic	0.32	
5% A-D Critical Value	0.729	
K-S Test Statistic	0.175	
5% K-S Critical Value	0.282	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	14.8
95% Percentile	16.4
99% Percentile	17.68

Assuming Gamma Distribution			
90% Percentile	17.73	95% UTL with 90% Coverage	18
95% Percentile	22.14	95% Percentile Bootstrap UTL with 90% Coverage	18
99% Percentile	32.08	95% BCA Bootstrap UTL with 90% Coverage	18
		95% UPL	18
95% WH Approx. Gamma UPL	24.44	95% Chebyshev UPL	34.56
95% HW Approx. Gamma UPL	25.72	Upper Threshold Limit Based upon IQR	25
95% WH Approx. Gamma UTL with 90% Coverage	31.09		
95% HW Approx. Gamma UTL with 90% Coverage	33.59		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

NitrogenAsAmonia

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Tolerance Factor	2.454		

Raw Statistics		**Log-Transformed Statistics**	
Minimum	95	Minimum	4.554
Maximum	200	Maximum	5.298
Second Largest	160	Second Largest	5.075
First Quartile	100	First Quartile	4.605
Median	120	Median	4.787
Third Quartile	140	Third Quartile	4.942
Mean	128.3	Mean	4.826
Geometric Mean	124.7	SD	0.247
SD	34.28		
Coefficient of Variation	0.267		
Skewness	1.246		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	212.5	95% UTL with 90% Coverage	228.8
95% UPL (t)	195.5	95% UPL (t)	202.5
90% Percentile (z)	172.3	90% Percentile (z)	171.2
95% Percentile (z)	184.7	95% Percentile (z)	187.3
99% Percentile (z)	208.1	99% Percentile (z)	221.7

Gamma Distribution Test		**Data Distribution Test**
k star	11.87	**Data appear Normal at 5% Significance Level**
Theta Star	10.82	
MLE of Mean	128.3	
MLE of Standard Deviation	37.26	
nu star	213.6	
A-D Test Statistic	0.354	
5% A-D Critical Value	0.721	
K-S Test Statistic	0.156	
5% K-S Critical Value	0.279	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
90% Percentile	168
95% Percentile	184
99% Percentile	196.8

Assuming Gamma Distribution			
90% Percentile	177.8	95% UTL with 90% Coverage	200
95% Percentile	195.1	95% Percentile Bootstrap UTL with 90% Coverage	200
99% Percentile	230.5	95% BCA Bootstrap UTL with 90% Coverage	200
		95% UPL	200
		95% Chebyshev UPL	285.8
95% WH Approx. Gamma UPL	199.5	Upper Threshold Limit Based upon IQR	200
95% HW Approx. Gamma UPL	200.2		
95% WH Approx. Gamma UTL with 90% Coverage	221.7		
95% HW Approx. Gamma UTL with 90% Coverage	223.3		

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Sulfate

General Statistics

Number of Valid Data	8	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	8

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Sulfate was not processed!

Table 2: ProUCL Output for Background Soil UPLs

OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

Acetone

General Statistics

Number of Valid Data	8	Number of Detected Data	3
Number of Distinct Detected Data	2	Number of Non-Detect Data	5

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful and reliable test statistics and estimates.
No statistics will be produced!

Tolerance Factor	2.582	Percent Non-Detects	62.50%

Raw Statistics

Minimum Detected	0.034
Maximum Detected	0.035
Mean of Detected	0.0343
SD of Detected	0.000577
Minimum Non-Detect	0.29
Maximum Non-Detect	0.38

Log-transformed Statistics

Minimum Detected	-3.381
Maximum Detected	-3.352
Mean of Detected	-3.372
SD of Detected	0.0167
Minimum Non-Detect	-1.238
Maximum Non-Detect	-0.968

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommende
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL	8
Number treated as Detected with Single DL	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.767

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.767

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean		0.115
SD		0.0685
95% UTL	90% Coverage	0.292
	95% UPL (t)	0.253
	90% Percentile (z)	0.203
	95% Percentile (z)	0.228
	99% Percentile (z)	0.275

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)		-2.397
SD (Log Scale)		0.811
95% UTL	90% Coverage	0.739
	95% UPL (t)	0.464
	90% Percentile (z)	0.257
	95% Percentile (z)	0.345
	99% Percentile (z)	0.6

Log ROS Method

Mean in Original Scale		0.0343
SD in Original Scale		0.000352
Mean in Log Scale		-3.372
SD in Log Scale		0.0102
95% UTL	90% Coverage	0.0352
	95% UPL (t)	0.035
	90% Percentile (z)	0.0348
	95% Percentile (z)	0.0349
	99% Percentile (z)	0.0352

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
95% Percentile of Chisquare (2k)	N/A
90% Percentile	N/A
95% Percentile	N/A
99% Percentile	N/A

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0343
SD	0.000471
SE of Mean	0.000333
95% KM UTL with 90% Coverage	0.0356
95% KM Chebyshev UPL	0.0365
95% KM UPL (t)	0.0353
90% Percentile (z)	0.0349
95% Percentile (z)	0.0351
99% Percentile (z)	0.0354

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	N/A
95% Hawkins Wixley (HW) Approx. Gamma UPL	N/A
95% WH Approx. Gamma UTL with 90% Coverage	N/A
95% HW Approx. Gamma UTL with 90% Coverage	N/A

Note: DL/2 is not a recommended method.

Benzaldehyde

General Statistics

Total Number of Observations	9
Number of Distinct Observations	8
Tolerance Factor	2.454

Raw Statistics

Minimum	0.036
Maximum	0.098
Second Largest	0.085
First Quartile	0.051
Median	0.058
Third Quartile	0.075
Mean	0.0629
Geometric Mean	0.0601
SD	0.0201
Coefficient of Variation	0.32
Skewness	0.54

Log-Transformed Statistics

Minimum	-3.324
Maximum	-2.323
Second Largest	-2.465
First Quartile	-2.976
Median	-2.847
Third Quartile	-2.59
Mean	-2.812
SD	0.32

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.96
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	0.112
95% UPL (t)	0.102
90% Percentile (z)	0.0887
95% Percentile (z)	0.096
99% Percentile (z)	0.11

Gamma Distribution Test

k star	7.532
Theta Star	0.00835
MLE of Mean	0.0629
MLE of Standard Deviation	0.0229
nu star	135.6

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.981
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	0.132
95% UPL (t)	0.113
90% Percentile (z)	0.0906
95% Percentile (z)	0.102
99% Percentile (z)	0.127

Data Distribution Test

Data appear Normal at 5% Significance Level

Table 2: ProUCL Output for Background Soil UPLs
OLIN Wilmington OU-1

General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	Data_For_ProUCL No Outliers.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
umber of Bootstrap Operations	2000

A-D Test Statistic	0.18
5% A-D Critical Value	0.722
K-S Test Statistic	0.162
5% K-S Critical Value	0.279

Nonparametric Statistics

90% Percentile	0.0876
95% Percentile	0.0928
99% Percentile	0.097

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	0.0935
95% Percentile	0.105
99% Percentile	0.128
95% WH Approx. Gamma UPL	0.108
95% HW Approx. Gamma UPL	0.109
95% WH Approx. Gamma UTL with 90% Coverage	0.123
95% HW Approx. Gamma UTL with 90% Coverage	0.125

95% UTL with 90% Coverage	0.098
95% Percentile Bootstrap UTL with 90% Coverage	0.098
95% BCA Bootstrap UTL with 90% Coverage	0.098
95% UPL	0.098
95% Chebyshev UPL	0.155
Upper Threshold Limit Based upon IQR	0.111

Table 3: Summary Stats for Background Evaluation

Analyte	Summary Statistics						Distribution		95% UPL (1)	
	Number Detected	Number of Results	Percent Detected	Range of Detects (mg//kg)			Normal	Lognormal	Value (mg/kg)	Rationale / Statistic
Benzo(a)anthracene	4	9	44%	0.012	:	0.017	X	X	0.0192	95% KM UPL (t) - Nonparametric
Benzo(a)pyrene	5	9	56%	0.014	:	0.022	X	X	0.0229	95% KM UPL (t) - Nonparametric
Benzo(b)fluoranthene	9	9	100%	0.018	:	0.048	X	X	0.0528	95% UPL (t) - Normal
Benzo(ghi)perylene	2	9	22%	0.015	:	0.021			0.0239	95% KM UPL (t) - Nonparametric
Benzaldehyde	9	9	100%	0.036		0.098	X	X	0.102	95% UPL (t) - Normal
Bis(2-Ethylhexyl)phthalate	6	9	67%	0.012	:	0.031	X	X	0.0305	95% KM UPL (t) - Nonparametric
Chrysene	6	9	67%	0.015	:	0.027	X	X	0.0282	95% KM UPL (t) - Nonparametric
Fluoranthene	8	9	89%	0.015	:	0.043	X	X	0.0436	95% KM UPL (t) - Nonparametric
Indeno(1,2,3-cd)pyrene	8	9	89%	0.015	:	0.035		X	0.033	95% UPL (t) - Lognormal
Naphthalene	0	9	0%	N/A	:	N/A			N/A	All values are nondetect
Phenanthrene	6	9	67%	0.014	:	0.035	X	X	0.036	95% KM UPL (t) - Nonparametric
Pyrene	8	9	89%	0.016	:	0.049	X	X	0.0501	95% KM UPL (t) - Nonparametric
Formaldehyde	5	5	100%	0.11	:	0.35	X	X	0.459	95% UPL (t) - Normal
Aluminum	9	9	100%	1400	:	13000	X	X	16279	95% UPL (t) - Normal
Arsenic	9	9	100%	0.64	:	10	X	X	11.66	95% UPL (t) - Normal
Barium	9	9	100%	3.5	:	15	X	X	17.66	95% UPL (t) - Normal
Beryllium	6	6	100%	0.042	:	0.32	X		0.4	95% UPL (t) - Normal
Cadmium	9	9	100%	0.037	:	0.26	X	X	0.321	95% UPL (t) - Normal
Calcium	9	9	100%	86	:	590	X	X	679.9	95% UPL (t) - Normal
Chromium	9	9	100%	1.5	:	10	X	X	12.79	95% UPL (t) - Normal
Cobalt	8	8	100%	0.45	:	2.9	X	X	3.41	95% UPL (t) - Normal
Copper	8	9	89%	1.7	:	5.8	X	X	6.698	95% UPL (t) - Normal
Iron	9	9	100%	610	:	12000	X		15564	95% UPL (t) - Normal
Lead	9	9	100%	7.8	:	26	X	X	27.73	95% UPL (t) - Normal
Magnesium	9	9	100%	24	:	1100	X	X	1215	95% UPL (t) - Normal
Manganese	9	9	100%	3.4	:	69	X	X	75.31	95% UPL (t) - Normal
Mercury	7	7	100%	0.048	:	0.11	X	X	0.115	95% UPL (t) - Normal
Nickel	9	9	100%	1.3	:	7.3	X	X	8.42	95% UPL (t) - Normal
Potassium	9	9	100%	51	:	580	X		682.3	95% UPL (t) - Normal
Selenium	2	9	22%	0.39	:	0.6			0.701	95% KM UPL (t) - Nonparametric
Silver	0	9	0%	N/A	:	N/A			N/A	All values are nondetect
Sodium	4	9	44%	33	:	48	X	X	50.02	95% KM UPL (t) - Nonparametric
Tin	9	9	100%	0.71	:	3.5	X	X	4.44	95% UPL (t) - Normal
Vanadium	9	9	100%	3.6	:	21	X	X	24.78	95% UPL (t) - Normal
Zinc	9	9	100%	1.9	:	18	X	X	19.64	95% UPL (t) - Normal
NitrogenAsAmonia	9	9	100%	95	:	200	X	X	195.5	95% UPL (t) - Normal
Sulfate	0	8	0%	N/A	:	N/A			N/A	All values are nondetect
Acetone	3	8	38%	0.034	:	0.035			0.0365	95% KM UPL (t) - Nonparametric

Notes

(1) Hierachy followed for UPL selection is normal distribution, lognormal distribution then nonparametric distribution. Nonparametric statistics are used for all analytes detected in less than 70% samples. For analytes detected in >70% samples, lognormal or normal UPLs (based on distribution of data) were retained.

N/A - UPL could not be calculated as all results were reported as nondetect.
95% UPL - 95% Upper prediction limit (see text for more detail)
mg/kg - milligram per kilogram